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# SCIENTIFIC AMERICAN

## Why Men Are Better Typewriters than Women

## New Jersey's Great Trunk Sewer System


Vol. CIX. No. 17
October 25, 1913

Munn & Co., Inc., Publishers
New York, N. Y.

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*Next Week's Issue of the Scientific American*

# The Inventors' Number

## The Ten Greatest Inventions

IN order to show the inventive activity of the present generation, the Scientific American recently placed the following question before its readers, and offered prizes for the three best essays on the subject:

WHAT ARE THE TEN GREATEST INVENTIONS OF OUR TIME, AND WHY?

Three prizes were offered of $150.00, $100.00, and $50.00 respectively. In judging the greatness of an invention it was suggested that practical success and general usefulness to mankind be used as a test. It was also stipulated that the inventions must be patentable and must be limited to machines, devices and discoveries commercially introduced in the last twenty-five years.

The contest closed on September 1st, and in next week's issue of the Scientific American we shall publish the essay winning first prize and the names of the three successful contestants.

The judges are HERBERT DE B. PARSONS and GUSTAV LINDENTHAL, both well known engineers of wide experience and broad view.

When the essays were opened it was noted that the contestants expressed a wide diversity of opinion as to the best inventions of our age. To show this disparity, we published a list of forty subjects named in a dozen of these essays and asked our readers to select from this list those which they considered the best ten. Although no prize was offered for this expression of opinion, we have received a large number of votes, showing the great interest of our readers in this question. The result of the vote will be published in next week's issue of the Scientific American.

In addition to the prize contest, the November Magazine Number will contain the usual variety of material and many articles of special interest to inventors.

SIXTY-NINTH YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIX
NUMBER 17.

NEW YORK, OCTOBER 25, 1913

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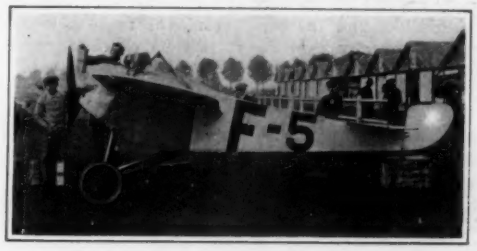
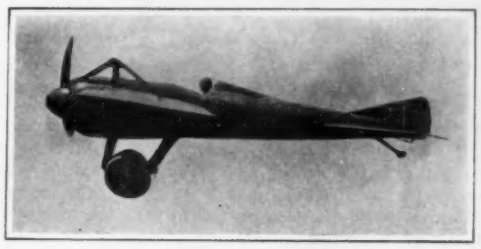
Prevost rounding a pylon.




The 160 horse-power Ponnier driven by Védrines.



Prevost, the winner, in flight.

The nose of Prevost's machine.

## The Race for the Gordon Bennett Cup

**By John Jay Ide, Special Aeronautic Correspondent of the Scientific American**

IT is eight o'clock in the morning at the Gare de l'Est, Paris, on Monday, September 29th. An enormous crowd is rushing for the train to convey them to Rheims in time to assist at the race for the Gordon Bennett Cup. The railway carriages are completely filled by standees who endure the two hours journey without a murmur. At Rheims we make a dash for the train marked "l'Aerodrome." It pulls out after about a dozen of us have clambered aboard, leaving the rest of the trainful on the platform.

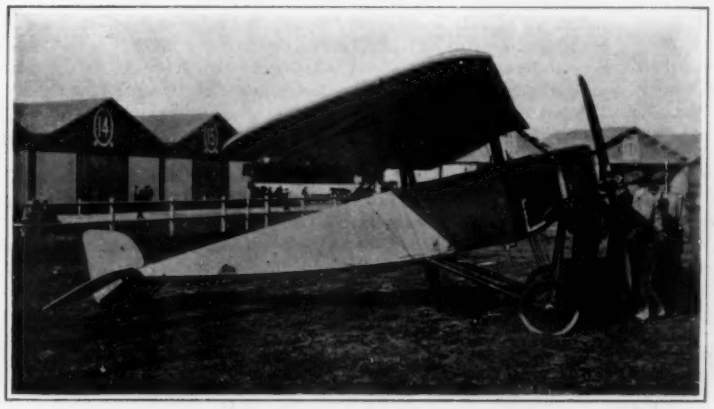
As we approach the flying ground we see young Crombez, the Belgian representative who had drawn the first departure, circling the course. He started at ten o'clock. Although his Deperdussin is equipped with a 160 horse-power Gnôme, he is not a likely winner as he plays very safe at the corners. His time for the 200 kilometers (124 miles) is announced as 1 hour 9 minutes 52 seconds, whereat the Frenchmen feel perfectly safe.

Early this morning, several hours before our arrival, Emile Védrines made a trial circuit with his 160 horse-power Ponnier, in 2 minutes 58 seconds, which is over eleven seconds better than Prevost's time in the eliminatories. On hearing this the Deperdussin manager became desperate and sent to the factory for new wings for Prevost's mount. These wings, which would support the machine only in ideal weather, such as we are having to-day, are almost perfectly flat on the underside and have a span of less than twenty feet.

The alterations are completed none too soon for Prevost to start at 11:15. The powerful Gnôme springs into action at the very first swing of the tractor and Prevost dashes away toward the grandstands, not taking wing until he speeds up to eighty miles an hour. The flight as seen from the timing pylon is impressive in the extreme. He flies very low, about sixty feet above the ground, but before reaching the pylon he rises to 75 feet, banks steeply, and dives around the corner, fairly shaving the pylon. When the timer announces that Prevost has completed 100 kilometers in 29 minutes 40 seconds, giving a speed of just over 202 kilometers per hour, we get greatly excited and speculate as to whether the 200 kilometers will be accomplished within the hour. As the twentieth lap is completed our hopes are realized, as the time is 59 minutes and 45 3/5 seconds, that is at a speed of 200.803 kilometers per hour (124.5 miles per hour).

On Prevost's return to the hangars he is given a royal welcome. A shout goes up for Bechereau, the brilliant and successful designer of the wonderful and justly celebrated Deperdussin monoplane. Meanwhile Gilbert starts in a Deperdussin, but with a greater wing spread and another make of motor—Le Rhône. This engine has all valves mechanically operated and uses less gasoline than the Gnôme, though of the same horsepower (160). Owing to the greater prestige of the production of the Brothers Seguin, Le Rhône is very seldom chosen by pilots. Gilbert takes over three minutes for his first round, so is seen to have no chance to wrest the cup from Prevost. The crowd adjourns to the restaurant, which does a roaring business serving a very poor lunch at ten francs a plate.

On Gilbert completing the 200 kilometers Emile Védrines starts on the all but hopeless task of beating Prevost's time. He is three seconds per lap slower than Prevost. If the Ponnier pilot had started first, however, he would have held the world's record if only for an hour, as he easily surpasses the times set up by Prevost on Saturday. With Védrines' descent comes to a close the last free for all Gordon Bennett Cup we shall probably ever see.



A new type of Morane-Saulnier driven by Garros.

Below are tabulated the figures relating to the cup:

*New World's Speed Records.*

Pilot Alone.

Prevost (Deperdussin—Gnôme 160 horse-power). Rheims, 29th September, 1913.

| | | | |
|---|---|---|---|
| 10 kilometers | ( 6.2 miles), | 2 minutes 56 3/5 | seconds. |
| 20 kilometers | ( 12.4 miles), | 5 minutes 54 1/5 | seconds. |
| 30 kilometers | ( 18.6 miles), | 8 minutes 52 1/5 | seconds. |
| 40 kilometers | ( 24.8 miles), | 11 minutes 50 1/5 | seconds. |
| 50 kilometers | ( 31 miles), | 14 minutes 48 1/5 | seconds. |
| 100 kilometers | ( 62 miles), | 29 minutes 40 | seconds. |
| 150 kilometers | ( 93 miles), | 44 minutes 38 | seconds. |
| 200 kilometers | (124 miles), | 59 minutes 45 3/5 | seconds. |

*Gordon Bennett Cup, 1913.*

200 kilometers (124 miles).

1. Prevost (Deperdussin—Gnôme 160 horse-power). 59 minutes 45 3/5 seconds. Average speed: 200.803 kilometers (124.5 miles) per hour.
2. E. Védrines (Ponnier—Gnôme 160 horse-power). 1 hour 51 2/5 seconds. Average speed: 197.5 kilometers (122.4 miles) per hour.
3. Gilbert (Deperdussin—Le Rhône 160 horse-power). 1 hour 2 minutes 55 2/5 seconds. Average speed: 191.1 kilometers (118.5 miles) per hour.
4. Crombez (Deperdussin—Gnôme 160 horse-power). 1 hour 9 minutes 52 seconds. Average speed: 171.75 kilometers (106.5 miles) per hour.

## Enforcing the Migratory Bird Regulations

FOLLOWING the proclamation of the President of the United States establishing regulations for the protection of migratory birds, the Department of Agriculture has set in motion machinery to make these regulations effective in every State on November 1st, the date set for the operation of the proclamation. These regulations put under Federal protection, for the first time, a large number of migratory game and insectivorous birds and thus place Federal restrictions on the five million hunters of the United States. In enforcing these regulations Federal authorities will co-operate with State game commissioners and other State authorities in carrying out the provisions of the law and to prevent complications in the local enforcement of the regulations.

Among the birds protected by the regulations are the brant, wild duck, goose, swan, cranes of various species, rail, several kinds of shore birds, pigeon, dove, wild pigeon, bobolink, catbird, chickadee, cuckoo, flicker, flycatcher, grosbeak, humming bird, kinglet, martin, meadow lark, night hawk, nuthatch, oriole, robin, shrike, swallow, swift, thrush, warbler, whippoorwill, woodpecker, and wren.

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**Curious Self-Starting Accidents.**—Of late examples have been seen of a disconcerting class of automobile accident which consists in the self-starting of the motor. The most recent one of the kind occurred upon the route from Chemnitz to Buchholz, near Berlin. An autobus fell over an embankment and 27 persons were wounded. The motor had suddenly stopped when on the road, and the driver descended in order to start it up. Meanwhile the motor started again and the autobus ran over the bank and fell for six feet. An accident of the same kind happened in Paris, where the automobile had been left for a short time with two children in it. The motor started up and the automobile ran into the Seine, where it was entirely submerged, with resulting loss of life.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

*The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.*


## The Peril of Fire at Sea

THE two principal risks to which those who travel by sea are exposed are foundering and fire. Eighteen months ago the loss of the "Titanic" proved that, even in these days of highly developed ship construction, the first of these risks was ever present and might be attended with appaling consequences. To-day the burning of the "Volturno" reminds us that fire—an ever-present menace in ocean travel—may occur at any moment, and may be attended with enormous loss of life.

The lesson of the "Titanic" disaster has been laid well to heart; and it is realized that, as far as is mechanically possible, every ship should be made its own lifeboat and should be built with such complete subdivision that its foundering at sea will be a very remote contingency. The lifeboat of the future must be a larger and more seaworthy craft, propelled by motors and capable of reaching the nearest rescuing steamship in safety.

But now comes the tragedy of the "Volturno" with its imperative demand that a searching investigation be made of the question of fire prevention and control on ships at sea. At the time of the loss of the "Titanic," the SCIENTIFIC AMERICAN urged that in the investigation of the question of safety at sea, the subject of fire risk should be given full consideration. This winter there will be held in London a great international gathering of experts to determine the best methods to prevent the repetition of such a disaster as happened to the "Titanic;" and the burning of the "Volturno" emphasizes the necessity for giving the deliberations of that gathering the broadest possible scope by including the subject of fire protection.

If carefully compiled governmental statistics of such fires, great and little, as occur on ships at sea were periodically published, the public would be amazed to learn how many and how serious the fires are. The passenger steamship companies are well aware of the imminence and seriousness of this risk, and the speed with which such fires as do occur in the passenger accommodations of ocean liners are detected and put out, reflects great credit upon the watchfulness and efficiency of the officers and crews. It should never be forgotten that the long reach of passenger accommodations, piled up as they are, deck above deck, and filled with highly inflammable materials, calls for special provision against spread of fire in the way of steel bulkheads, carried clear across the ship from side to side and extending to the topmost deck. These fire bulkheads should be provided with effective fire doors, wherever they are intersected by the alleyways, and fire drills, with every member of the crew at his station, should be regularly carried out. Each fire compartment as thus divided off should be provided with its own independent fire hose connections, and these should be numerous, well distributed and of large capacity.

It is not the small fires in the passenger accommodations, however, which grow to serious proportions; the fires that endanger the ship, such as this that broke out on the "Volturno," originate below deck, and usually in the hold or in the coal bunkers. Such fires as the recent outbreak on the "Imperator" are difficult to get at, and exceedingly difficult to put out. A coal bunker fire is proverbially stubborn and persistent, and an officer of the Navy has recently told us that in this service, even the long-continued filling of an entirely closed bunker compartment with steam has more than once failed to subdue a fire therein. A fire in the hold of the ship, particularly if it is filled, as in the case of the "Volturno," with highly combustible material, presents an even more puzzling problem; for it is more difficult to exclude the air from a hold than from a coal bunker.

Why is it that the automatic sprinkler, which has proved so highly efficient ashore, has not been applied to the protection of ships? Structurally considered, the problem should not be a difficult one, since the system might be placed inconspicuously in the cabins, alleyways, and saloons, and the piping, fuses, etc., being overhead, would not interfere with the loading and unloading of the various holds. An abundance of water supply under high pressure is always available aboard a steamship, and the piping could be made of such generous capacity, that the putting out of an incipient blaze, even in a hold stored with inflammable material, may be rendered a practical certainty.

Two conspicuous lessons are that wireless has again established its priceless value as a means of saving life at sea, and that the present lifeboat must be abandoned and a new type of large, seaworthy, power-propelled boat must be substituted in its place, and provided with launching mechanism powerful enough and of sufficiently wide reach to place these larger lifeboats in the sea, well away from the ship, and clear of any risk of being wrecked by collision with the same. The "Grosser Kurfuerst" seems to have used a power boat which did noble service in a sea in which oar-propelled lifeboats were comparatively powerless.

## To Beautify the Panama Canal

THE National Commission of Fine Arts, through its chairman, Daniel C. French, has placed before the Government its views on the question of beautifying the Panama Canal. Congress in August, 1912, authorized the Commission to report its recommendations regarding the artistic character of the structures of the canal, etc., and into this question the Commission has entered very thoroughly and with conclusions which reveal a correct judgment of the situation.

"The canal," says Mr. French, "like the Pyramids, or some imposing object in natural scenery, is impressive from its scale and simplicity and directness. One feels that anything done merely for the purpose of beautifying it would not only fail to accomplish that purpose, but would be an impertinence."

Bearing in mind the character of the Commission, it may be said that the above conclusion was inevitable, for it is certain that even the casual visitor to the canal, if he be possessed of any artistic sense, or sense of the fitness of things, must realize that the adornment of the canal on any extensive scale is an utter impossibility. The shoreward view as one enters from the Atlantic is flat and uninteresting, and presents no natural feature which invites the erection of any adequate monumental structure. The fine two-mile breakwater extending from Toro Point terminates in a lighthouse for which the Commission has made some alternative plans that have been adopted. It is proposed that if suitable foundations can be developed, a monumental lighthouse should be built where the dredged channel through the bay commences, or else that a lighthouse be located near the position marked by beacon lights 1 and 2. If this is impracticable, it is recommended that a lighthouse or some form of monument be constructed on the first high solid ground encountered in entering the canal from the Atlantic, say at the Mindi Hills where the Gatun locks first attract attention. Unless this structure be built on a scale commensurate with the magnitude of the canal, we think it had better be omitted altogether.

Although the Commission felt that it was desirable to mark the entrance to the canal from the Pacific in a manner similar to that proposed for the Atlantic end, it was found that the conditions were not favorable to such a structure, and it considers that nature has provided in the shore line itself, with its rugged range of mountains, and in the interesting islands guarding the entrance, an approach which is sufficiently imposing in itself.

The most practical suggestion, one which we believe will meet with general approval, is that for the construction of a vast memorial tablet in the Culebra cut. It is proposed to form an impressive inscription upon a great monumental surface at some point of prominence, and preferably on the east wall of the cut at the point of the deepest cut—492 feet—where the canal passes through the Continental Divide. The Commission suggests that the tablet should be approximately 100 feet in height, and somewhat more in width; that it should be severely simple in design, and that the lettering should be done in Roman V-shaped letters, large enough to be easily read by normal eyes from the opposite side of the canal. It is proposed that the material shall be concrete and applied as a massive facing to the trap rock of the cliff.

Now here is a suggestion which seems to us to be altogether appropriate; and we trust that when the subject matter of the inscription comes to be decided upon, care will be taken to make record of the fact that the successful carrying through of the great cut was due to five years of continuous supervision by that capable and faithful officer, Col. D. D. Gaillard, whose health was disastrously wrecked on the eve of the completion of the work.

## What Have the Russians Discovered in the Arctic?

A PRESS dispatch from St. Michael, Alaska, dated October 11th, announced the arrival at that port of the Russian government vessels "Taimyr" and "Waigatch," just back from a summer cruise in the Arctic, in the course of which had been discovered a hitherto unknown land, vaguely described as "extending beyond latitude 81 north and longitude 102 west," and said to be "as large as Greenland." This information was somewhat modified in subsequent dispatches. The newspaper accounts of the discovery, however, up to this writing, have persistently distorted its true character and importance, and it, therefore, seems desirable to attempt a reconstruction of the story in the light of known facts.

The vessels in question, which are ice-breakers, were first assigned to Arctic work in the summer of 1911, when they were sent by the Russian government to escort the expedition of Admiral Trajan, on the "Kolyma," to the Arctic coast of Siberia *via* Bering Strait, but were turned back by impassable ice, the "Kolyma" proceeding without them. The following summer they made another attempt, entered the Arctic Ocean, carried out important explorations and surveys as far west as the mouth of the Lena, and made an unsuccessful effort to pass the Taimyr Peninsula, in order to complete the Northeast Passage to Europe. Early last July they sailed from Vladivostok on the voyage which they have just completed. The last expedition was commanded by Major General Sergejev, but he was forced by illness to leave the party in Bering Sea, and returned south on a Russian cruiser, leaving the command to Lieut. Wilkitzky. When last previously heard from the ice-breakers were off the northern Siberian coast and were understood to be making another attempt to pass the Taimyr Peninsula. It was not anticipated that they would try to reach the high latitudes which they appear to have attained.

According to later and more circumstantial reports, the explorers were endeavoring to reach the mouth of the Yenisei, but on account of ice along the coast, turned north, and thus stumbled upon the new land, which they encountered about 60 miles north of Cape Chelyuskin. They cruised northwesterly along the margin of the land to latitude 81, longitude 96, where a solid pack prevented further progress, though the land could still be seen extending to the northwest. In the opposite direction the coast-line was followed to longitude 104, latitude 79, where it turns to the northeast. The land is mountainous, and gives evidence of recent volcanic activity. The explorers landed, raised the Russian flag, and took possession in the name of the Czar, naming the land "Nicholas II. Land." In all, about 200 miles of coast-line appears to have been actually seen by the explorers—a very far cry indeed from the "Arctic continent" or "land as large as Greenland," of which the newspapers have been telling us.

Reference to any one of the numerous maps of the Arctic regions on which is shown the route over which Nansen drifted in the "Fram," in 1893-96, will furnish convincing evidence that the newly discovered land must be of very small extent as compared with a continent. When the first report of the discovery was received it seemed possible that the longitude had been incorrectly reported, or that the explorers had reckoned their longitude from Pulkova instead of Greenwich. In either case the new coast might have been the border of a land mass of great extent, occupying the site of the hypothetical continent or archipelago required, according to Dr. R. A. Harris, to explain the Arctic tides, i. e., the *terra incognita* which the Crocker Land expedition is now seeking to attain from the southeast and the Canadian Arctic expedition from the south. This supposition was, however, dispelled by the definite statement, in a later report, that the new land begins 60 miles north of Cape Chelyuskin. It must therefore lie between the route of the "Fram" and the Siberian coast. Moreover, as Nansen obtained soundings of from 10,000 to 11,000 feet only two or three degrees north of the Russian discoveries, and found no evidence of land in that vicinity, Nicholas II. Land can hardly extend very far north of where it was actually seen by its discoverers, and can have no physical connection with the extensive lands which many geographers believe to exist north of Alaska and easternmost Siberia. The prospective laurels of Stefansson, or MacMillan, or Amundsen—as the case may be—are still safe.

## Engineering

**British Dreadnought Strength.**—According to the *Naval and Military Record*, by March 31st of next year Great Britain will have in commission 32 dreadnoughts and Germany will have 15. The *Record* notes the fact that for a short time at least, Great Britain will have reached its desired standard of two ships to one in battleships of the dreadnought type.

**The Jura Tunnel Completed.**—The boring of the Mont d'Or tunnel between France and Switzerland, which was commenced about three years ago, was completed on October 10th, when the two gangs which had been working from the Swiss and the French sides met. The tunnel which is 3 3-4 miles in length pierces the Jura mountains from Fresne to Vallorbe, saving thereby a seven-mile detour by Pontarlier. The line will be open for traffic early in 1914.

**New Material for Automobile Roads.**—Experimental tests giving satisfactory results have been made in France with a new road-surfacing material, which has been devised specially for automobile traffic. It consists of a mixture of what is called "iron straw," which consists of fine filaments of iron in a wiry or fibrous mass mixed with cement and sand. It is stated that the iron is not a waste product, but it is made by machines designed for the purpose.

**A Boy-Scout Cantilever Bridge.**—An effective cantilever bridge built by boy-scouts is illustrated in *Engineering News*. The bridge was built after a sketch made by Prof. D. B. Steinman of the University of Idaho. A 24-foot suspended span consisting of two 6-inch logs passes into grooves beveled at the ends of the 8-inch logs forming the cantilever arms, the latter being buried under a rock fill, in inclined holes dug in the banks of the river. The roadway consists of cross logs held in place by longitudinal stringers.

**Cost of the Panama Canal.**—Up to date the Panama Canal has cost $314,370,978. The total cost when completed will be within the original estimate of $375,000,000. Engineering has cost $185,316,095, and of this nearly $84,000,000 has been spent on the Culebra cut. Sanitation—a fundamental necessity if the canal was ever to be built—has cost $16,250,164. The sale of old material, the work done for outside companies, and water rentals from Panama have yielded the United States about $10,000,000.

**A Difficult Bridge Problem.**—The city of Calgary, Alberta, has recently solved a problem of bridge construction in a novel manner. The town lies on each side of the Bow River, that portion on the north bank being built on the high bluffs which border the river. To bridge the river on an incline to the top of the bluff would have been to neglect the portion of the city lying at the foot of the bluff. To make a deep cutting would have spoiled much of the property. The problem was solved by constructing a level bridge across the river, and then gaining the heights above by an inclined tunnel bored through the cliffs.

**British Fire-Director Gunnery Record.**—The British battleship "Centurion" has made a fine record in its gunlayers' test, which may be compared with that of the "Arkansas" recently published in this journal. The firing was done under the Percy Scott fire-director system. A pair of 13.5-inch guns in one of the amidship turrets fired eight rounds and scored eight hits in 2 minutes 35 2-5 seconds at a range of 7,000 yards. From another turret a gun crew of royal marines made six hits out of eight rounds. In each case the target was 14 feet square. If the report is correct, this is a very small target for such a range.

**The Straits of Panama.**—The chief engineer of the Panama Canal Company when the work was in French hands, Philippe Bunau-Varilla, in a dispatch from Colon, states that the completion of the lock canal will mark the beginning of its transformation into a free strait at sea level. Varilla has always favored the construction of a sea-level canal by the hydraulic method. He proposed commencing at a summit level fed with water from the Chagres, and using hydraulic dredges, successive longer reaches enclosed by end dykes being filled with water as the depth of the cut increased. The scheme was not considered to be practicable by the Isthmian Canal Commission.

**The Canal, the Merchant Marine and the Navy.**—Writing in the *Navy*, Winthrop L. Marvin points out that the American-Hawaiian Line has built and is building eight new vessels of six and seven thousand tons for service through the Panama Canal, which will bring the number of ships to be operated under this flag to 26, with a carrying capacity of 225,000 to 250,000 tons of coal. These ships would be available to serve as colliers for our navy in case of war. Other coastwise owners are enlarging their fleets, and the activity has extended to the Great Lakes shipyards; the whole outcome of which, as affecting the navy, will be that not only will a fine fleet of colliers be available, but the enlarged fleet will provide a body of men trained to the sea and suitable for enlistment.

## Science

**Professor Friedrich Pockels,** the well-known German physicist and editor of the *Beiblätter zu den Annalen der Physik*, died August 29th at the age of 58.

**The Next Eugenics Congress.**—It has been decided that the next international Engenics Congress will be held in New York in 1915, on or about September 20th.

**The Northeast Passage.**—The Russian ice-breakers "Taimyr" and "Waigatch" left Vladivostok early in July on a voyage *via* Bering Strait to the Arctic coast of Siberia. It is proposed to renew the attempt made by the same vessels last year to round the Taimyr peninsula and pass through the Sea of Kara to Europe.

**Gasometers as Aerial Signposts.**—In accordance with a resolution adopted by a gas congress recently held at Toulouse, a number of gas companies in France have agreed to paint direction and geographical signs on the roofs of their gasometers for the guidance of aeronauts. A numerical system of signs elaborated by the National Aerial League will be adopted.

**Water Power Development in Iceland.**—A consular report states that an English company has just purchased Dettifalls, the largest waterfall in Iceland, situated about 35 miles from the seacoast, on the River Tokulsa. The company proposes to erect large works for producing fertilizer from atmospheric nitrogen and to build a railway from the coast to the falls.

**Cloth from Seaweed.**—The much talked of English project of utilizing the fiber of a seaweed, *Posidonia australis*, as an admixture with wool in blankets, various kinds of cloth, and for the warp of carpets, appears to have come to grief. An order in Chancery was recently made for the compulsory winding up of the company engaged in exploiting this scheme. The embarrassment of the company is, however, reported to have been due to causes not militating against the feasibility of the process in question.

**Use of the Camera for Judging Races.**—An automatic photographic apparatus for judging races has proved successful in France and will be used at the next Paris international race meeting. A camera is placed in line with the winning post, and the winning horse, by breaking a thread, releases the electrically controlled shutter and a photograph of the finish is taken. A similar device was used at the last Olympic Games at Stockholm, but there the photographs were chiefly used as additional evidence in case of a disagreement between the judges.

**Vacant Lot Gardens** in our large cities represent a form of practical philanthropy that is attracting favorable attention throughout the country. In Philadelphia, according to the last annual report of the Philadelphia Vacant Lots Cultivation Association, the land is lent free of charge by the owners. The association spends about $5 a garden for plowing, fertilizer, seed, etc. Each garden is assigned to a family, which pays $1 the first season, $2 the second, and so on, until the fifth season, when about the full cost is collected. In 1912 442 families were assigned gardens, averaging about one sixth of an acre. The families spread the fertilizer, and plant, cultivate and harvest the crops, supplying their own tables and selling any surplus.

**Interesting Work for Telescopists.**—The American Association of Variable Star Observers has just completed its second year's work with a total of 12,900 observations to its credit as compared with 6,180 observations contributed last year. The association has a membership of twenty observers, and is under the direction of Prof. E. C. Pickering, Director of the Harvard College Observatory. The value of co-operative observing in this line of telescopic work has been fully demonstrated, and it is hoped that more telescopists will join the ranks of the association. Here is a splendid opportunity for anyone with a telescope of three-inch aperture or larger to engage in an interesting and practical line of scientific research. Those interested are requested to address William Tyler Olcott, Corresponding Secretary, Norwich, Conn.

**How the Government Tests Paper.**—In the SCIENTIFIC AMERICAN for October 4th, there appeared an article entitled "How the Government Tests Paper." Under the heading "Analyzing Loaded Papers" there appeared the following statement: "The amount of ash thus obtained is really less than the actual amount of loading or filler, which may contain water or other volatile agents that pass off in the burning." This statement requires explanation, as it takes no account of the natural ash of the fibers used or the ash from other raw materials. Except in the case of calcium sulphate fillers, the amount of water or volatile matter would not exceed five or ten per cent of the weight of the filler present. As the natural ash may be as high as 1.5 per cent of the weight of the paper, and in a sized paper is seldom, if ever, less than 0.4 per cent, it is apparent that the statement given would create a false impression of unloaded or slightly loaded papers, where the ash is in excess of the amount of filler in the paper.

## Automobile

**A Sectional Rim Spring Wheel.**—August Gerleit of New York city has patented, No. 1,066,267, a vehicle wheel which has spring spokes and a rim composed of separate sections. The outer ends of the spokes are secured to the adjacent ends of their respective rim sections. The connection between the spokes and the rim is a sliding one.

**A Mowing Attachment for Motor Vehicles.**—In patent No. 1,069,705 Otto Kluge of Golconda, Ill., combines with an automobile flywheel a mowing device driven by a shaft operated from the flywheel of the automobile motor, suitable controlling and supporting means being arranged in connection with the other parts of the apparatus.

**Two Patents for Eye Protectors.**—Gilbert D. George of St. Paul, Minn., has secured two patents Nos. 1,070,334 and 1,070,335, for eye protectors, in both of which two flexible transparent shields are arranged to overlap and are pivoted together, and in one patent the shields are concavo-convex so they may nest together when folded. When the shields are opened out they present the appearance of spectacles and are similarly used.

**Special Roads for Automobiles.**—The increasing use of automobiles in Europe is leading to the construction of special routes reserved exclusively for this class of traffic. One of the first of these to be built in Germany of extensive length is to run between Düsseldorf and Dortmund, and it will have about 80 feet width throughout the whole length, according to the present project. As to the part of the route which traverses Westphalia, the several municipalities are now discussing the plans.

**Combination Lock for Sparking Circuit of Automobile.**—Recent publications mention a combination lock for use in the sparking circuit of an automobile in which a pushpin combination lock is utilized in completing the circuit. In 1904 Fay Leone Faurote of Ann Arbor, Mich., took out a patent, No. 759,600, for an apparatus, the object of which was to provide a switch in the electric circuit of an automobile which circuit could be completed only by a predetermined definite arrangement of parts not apparent to the observer. The parts to be so arranged were the elements of a combination lock. Somewhat similar devices have been provided in the patented arts in which combination locks have been arranged in connection with the electric circuit and some of the valves, in some instances the fuel valve of an automobile, in such manner as simultaneously to control both the circuit and the valve.

**United States Leads in Motor Vehicles.**—At the recent International Road Congress held in London, a complete census of the world's motor vehicles was compiled for the first time. As the United States leads in the production of automobiles, so she also leads in their operation. It was learned that this country possesses more than half of all the motor vehicles in the world, the number, including motor cycles, being 628,185 as compared with England's 125,728. The balance of a total of 1,161,911 is distributed throughout the other countries of the world. France ranked third with 89,185, and Germany fourth with 70,006. The total number of motor trucks, included in the above figures, is given as 69,556. Usually the number of automobiles in any country greatly exceeds the number of trucks, although Germany is reported as having 49,126 trucks and only 15,618 pleasure cars. It should be noted, however, that these figures are based on reports dated June 1st, 1912, and probably fall far short of the actual number of vehicles in use to-day. It is estimated that there were no less than 300,000 motor vehicles manufactured and put into service during the past year.

**A Fluid Steel Ring Shock Absorber.**—It is estimated that upward of $20,000,000 a year is being spent by motor truck users in this country for repairs and replacements, caused chiefly by road shocks. The permanent success of the whole motor industry depends, in no small measure, upon overcoming this greatest enemy to its progress and profit. In a former issue we gave a sketch of a device called the shock shifter hub, which is reported by the London General Omnibus Company to give every satisfaction for the purpose. We have had a number of requests for further information as to its construction. It may be stated that the part of the axle within the wheel is surrounded by layers of steel balls of about ¼ inch in diameter, left free to move in any direction. Owing to their fine points of contact these balls act as a "fluid steel ring" around the axle and thus effectually divert from it and convert both lateral and vertical shocks into rotary motion as the wheel revolves. The superimposed pressure of the vehicle through the axle exerted on the balls causes a centrifugal action which the road shock merely accentuates in the chamber containing the balls. Thus the axle is entirely protected from shock, while in the ordinary rigid wheel it becomes the medium of communicating destructive vibrations to every fiber of the vehicle.

# Are Men Better Typists Than Women?

## Interesting Scientific Tests Made by J. M. Lahy

By Jacques Boyer

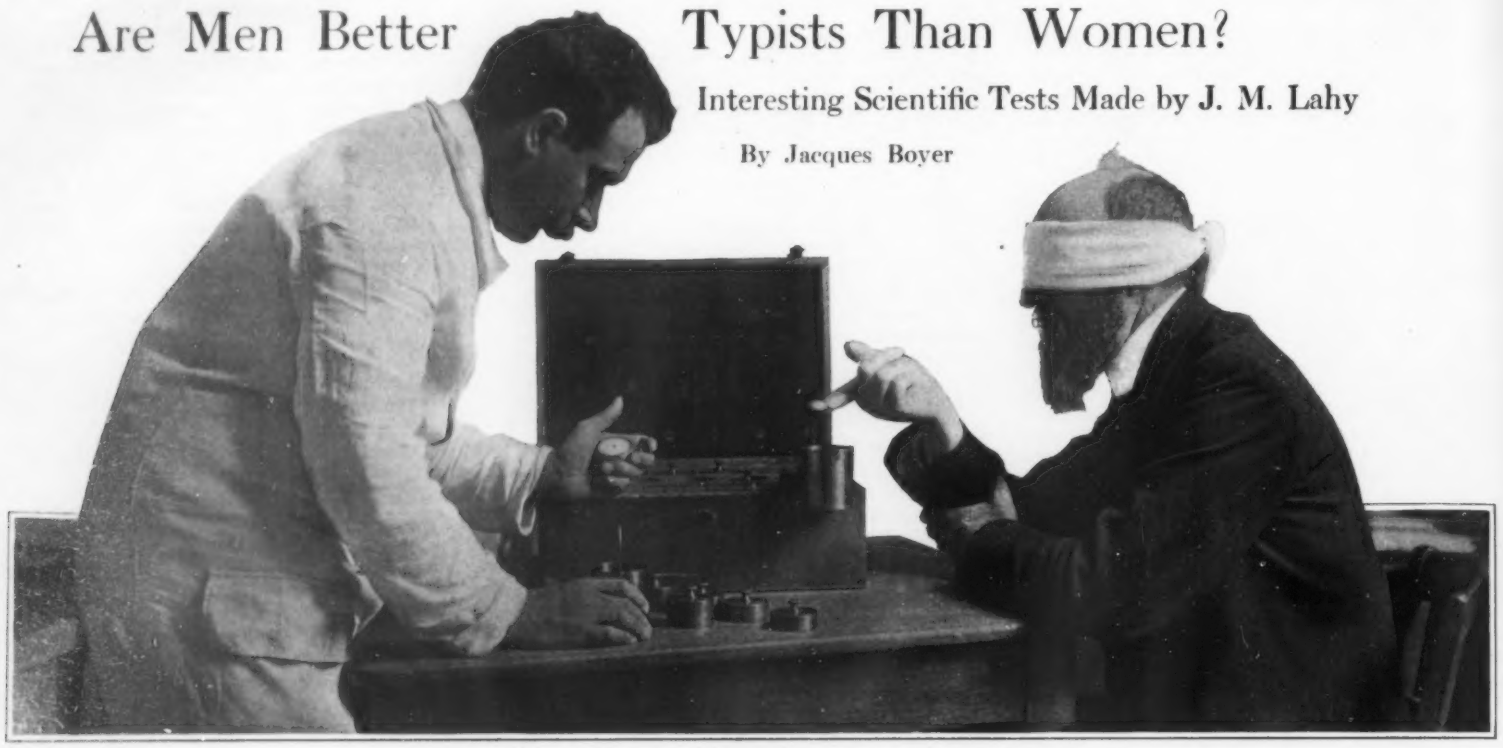


**Fig. 1.—Measuring the muscular sensibility with the myo-esthesimeter.**

WHAT are the aptitudes essential to success in the typewriting profession? How can these aptitudes be defined and measured scientifically? Are men superior to women in the operation of the writing machine? J. M. Lahy has endeavored to solve these psychological problems, and although his experiments have not yet been carried far enough to allow a definite conclusion to be stated, they possess an unquestionable social interest. In particular, they prove that slow action, perfectly adapted to its purpose, is more effective than rapid but ill-co-ordinated movements, and also that the sensorial reactions of typists are different in the two sexes.

From the numerous subjects examined by M. Lahy eleven persons, varying in age from twenty to thirty years, were selected as being strictly comparable. Six of these were women, who had had from two to four years' practice in typewriting, and five were men, whose experience ranged from two to eight years.

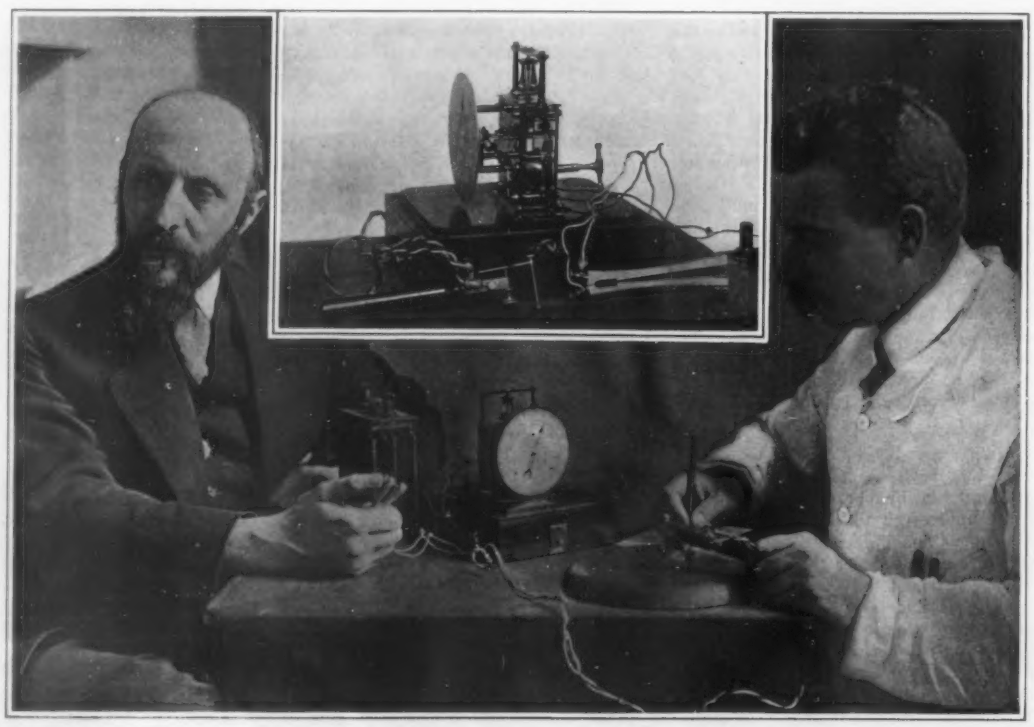
In order to effect this classification, the typists were required to typewrite an ordinary text containing 1,702 letters and figures, and their copies were submitted to the judgment of an expert typist. After this preliminary test M. Lahy measured, for each individual, the tactile sense of pressure with the Weber compass, the muscular sensibility with the myo-esthesimeter, the auditory reaction-time with the d'Arsonval chronoscope, and the muscular strength of each hand with the Régnier-Chéron dynamometer. He also examined, by means of appropriate tests, the memory for letters and phrases, the attention and some higher intellectual faculties, including imagination, abstraction, judgment and reasoning.

I will now describe briefly the construction and operation of the instruments mentioned above.

The haphi-esthesimatric compass of Weber, improved by Toulouse and Piéron (Fig. 3) consists essentially of two fine needles attached to an oscillating lever. The distance between the points of the needles is varied and measured by means of a graduated slide provided with a knob. The operator, holding the compass by its stem, applies it to the closed hand of the blindfolded subject so that the two needles exert equal pressures. He then notes the minimum distance to which the needles must be separated in order to give the impression of two distinct contacts.

**Fig. 2.—Measuring the strength of the hand with Régnier-Chéron dynamometer.**

**Fig. 3.—Measuring the tactile sense with the Weber compass. The operator holding the instrument by its stem and applying it to a closed hand to give impression of two distinct contacts.**



**Figs. 4 and 5.—The d'Arsonval chronoscope and the method of its employment in measuring the auditory reaction-time.**

In testing the memory for letters and phrases, attention and certain associative intellectual processes, M. Lahy employs an electromagnetic apparatus which can be operated at the desired instant by pressing a button (see cover). In this way appropriate test objects are suddenly uncovered by the withdrawal of a screen, moved by the electromagnet or an opposing spring. The examiner, watch in hand, measures the subject's quickness of thought by the number of verbal associations made in a given time, which should be long enough to make small experimental errors negligible.

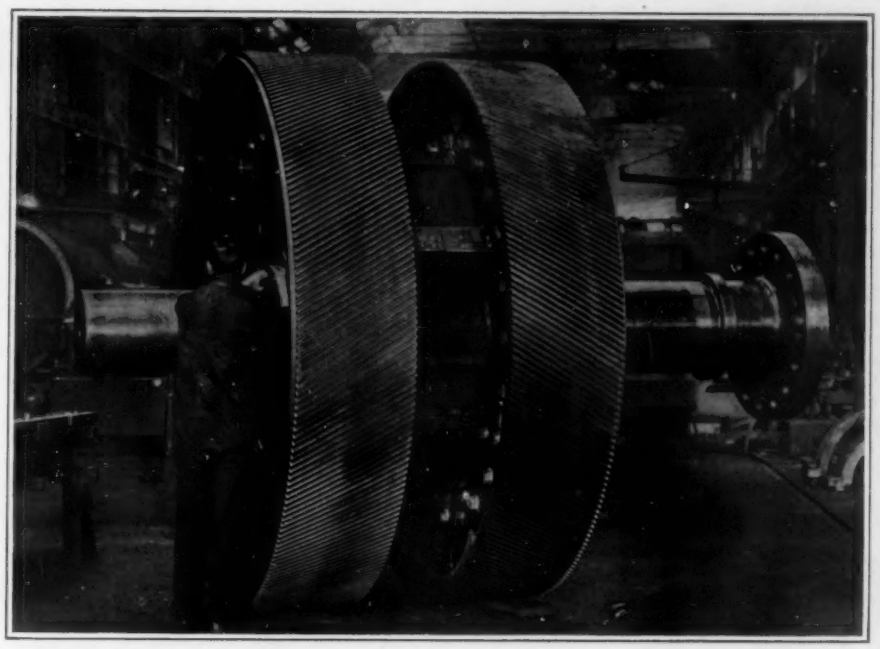
The acuteness of muscular sensibility is determined by the minimum perceptible difference in weight between two little metal buckets of equal size which are suspended alternately from the tip of the subject's finger. One bucket is of constant weight and serves as a standard of comparison while the weight of the other bucket is progressively increased by the addition of metal disks. The myo-esthesimeter of Toulouse and Vaschide (Fig. 1) comprises four pairs of buckets,

(*Concluded on page 326.*)

# Turbine Reduction Gear in Relation to Battleship Fighting Power

## How Light Reduction Gear Turbines Would Add Two Fourteen-inch Guns to the "Nevada"

BROADLY stated, the guiding principle in the design of a battleship is to obtain the maximum amount of fighting power upon a given displacement. Displacement, that is to say, the total weight of the ship and her equipment when she is afloat, is the capital which the architect has to draw upon in getting out the plans for his ship. Thus, in the case let us say of the "Nevada," a ship of 27,500 tons displacement, so much of this displacement is devoted to the hull, so much to the motive power, so much to the armament, so much to the armor and so much to the stores and miscellaneous equipment. As the result of the apportionment of weights to these different requirements, we have in the "Nevada" a ship 575 feet long, 95½ broad, protected by 13½ to 18-inch armor, with a sea speed of 20.5 knots, and carrying a battery of ten 14-inch guns. This represents an allotment of weight to the various elements of the ship which results in what we believe to be the most effective battleship of her displacement in the world to-day.



**The spurwheels of a Westinghouse helicoidal reduction gear for transmitting 6,000 horse-power at the station of the Cleveland Electric Illuminating Company. Efficiency in shop test over 98 per cent.**

Some other naval architect, however, realizing that he had the great displacement of 27,500 tons at his disposal, might have decided that such a ship should carry a heavier battery and he might have designed one of the same size, mounting twelve in place of ten 14-inch guns. But in doing so he would have been obliged to sacrifice some other valuable feature in her design. He would have found it necessary, let us say, to reduce the thickness of the armor to that of a battle-cruiser, or it would have been necessary to reduce the amount of coal carried and give to the ship a less generous amount of ammunition and stores; in short, he would have been obliged in some one, or in several ways, to sacrifice certain features which make the "Nevada" such a fine all-round fighting unit.

One of the largest drafts made upon the displacement capital of a warship is that for the boilers, engines and fuel supply; and for many years it has been realized that, if some change of motive power, or some radical change in existing methods, could be made involving a reduction in weights, it might be possible, on the same displacement, to produce a ship of greatly increased fighting power. When the steam turbine made its appearance as a practicable drive, it was predicted that its high efficiency and decreased weight would render this possible; but that these expectations have not been realized is shown by the fact that the "Oklahoma," sister ship to the "Nevada," and of the same displacement and armor protection, is being equipped with triple-expansion, reciprocating engines. It was hoped that the heavy-oil engine of the Diesel type would make possible the desired reduction in weight; but at the present writing it is agreed among the most experienced builders of oil engines, that there is little hope of this type of drive being installed in battleships for many years to come. During the past few years however, there has been brought to perfection an adjunct of the steam turbine which promises to enable that most efficient engine to demonstrate its full economy, both in weight and in fuel consumption, as a drive for vessels of the navy and merchant marine. We refer to the reduction gear, a device which makes it possible to combine the most economical type of turbine with the most economical type of propeller in any given ship. The difficulty with the marine turbine is a fundamental one. It lies in the impossibility of reconciling the high speed of rotation necessary to secure high efficiency in the turbine with the low speed of rotation which is necessary to secure high efficiency in the propeller. If the turbine is run at its maximum efficiency speed, there is a great loss of efficiency in the propeller; if the propeller is run at its own maximum efficiency speed, there is a consumption of steam in the turbine out of all proportion to the power delivered. A high peripheral velocity is necessary for the turbine blades, if they are to utilize the energy of the steam efficiently, and hence if the speed of rotation is limited, the desired peripheral speed can be secured only by an increase in the diameter of the rotor. This brings with it the disadvantage that the turbines become objectionably large, and heavy to handle during inspection and repairs. Furthermore, the large casings necessary in turbines of great power, are liable to expand unevenly when the steam is first admitted. This is liable to bring them in contact with the blades, whose clearances are necessarily very small, strip them from the rotor and necessitate the return of the crippled ship to the navy yard.

During the past few years, a large amount of costly experimental work has been done in the endeavor to introduce between engine and propeller some form of reduction gear, by which the high speed of the turbine shaft could be reduced to the relatively low speed of the propeller shaft, without any serious loss of efficiency. These efforts have resulted in the production of three types: I, the electrical, in which a high speed turbine is direct connected to a generator, current from which drives a motor direct connected to the propeller; II, the hydraulic type, which introduces between the power and the propeller shaft a reduction gear, which may be broadly defined as a combination of a centrifugal pump and a water wheel; III, a straight mechanical gear, consisting of a pinion on the power shaft gearing with a spur wheel on the propeller shaft. Type number one, for which an efficiency of 90 to 95 per cent is claimed, has been installed on the United States collier "Jupiter." Type number two, which has shown an efficiency of 90 per cent in a brake test of 10,000 horse-power, is being installed on a large scale in a German merchant ship. Type number three, of which the Westinghouse-MacAlpine reduction gear is the best known type, has been placed in the collier "Neptune," of 19,360 tons displacement and 14 knots speed, in which it has shown the same mechanical efficiency of 98 per cent as was revealed by the preliminary shop tests. Parsons, of turbine fame, has made some smaller installations on this principle, in high-speed passenger boats, which appear to be giving good satisfaction. At the present time, moreover, there are in land service 22 sets of Westinghouse gearing with an aggregate horse-power of about 29,590, and we present an illustration of one of two sets of 6,000 horse-power which are now in service at the station of the Cleveland Illuminating Company. Fifty-four additional sets of gears, having an aggregate horse-power of 67,000 horse-power, are under construction.

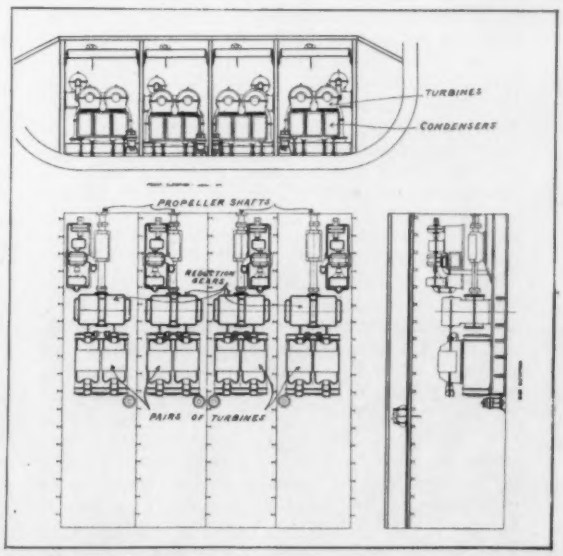



**Diagram showing saving of space by using mechanical reduction gear with high-speed turbines in the engine room of a 30,000-ton battleship. Saving of weight is 400 tons.**

The distinctive feature of the Westinghouse gear which, as can be seen from the illustrations, is of the double helicoidal type, is that the pinion shaft and bearings are supported hydraulically in such a manner that there is an automatic equalization and distribution of the tooth pressure. This effect is secured by locating an hydraulic cylinder and piston under each of the three pinion shaft bearings, which are held in a common frame. The lubricating oil enters the bearing at the region of low pressure and is carried around to the region of high pressure, where a portion of it is discharged through an opening leading to the hydraulic cylinder. Under this arrangement, the frame in which the pinion shaft is carried floats upon the oil contained in the hydraulic cylinder, and, since the pressure in these is permitted to equalize, there is a resulting automatic alignment of the pinion teeth with those of the main gear, and there is consequently a uniform distribution of tooth pressure. The smoothness and entire absence of noise suggests that a cushioning effect is obtained by a small amount of entrained air which amplifies the effect of the floating bearing.

Tests which were made at the Westinghouse shops with a turbine of a capacity of 1,000 kilowatts, at 3,600 revolutions per minute, brought out the very important fact for marine purposes, and particularly for naval purposes, that the efficiency remains practically constant over a very wide range of power, and with no apparent diminution at the highest power attained, and this in spite of the fact that the turbine was being operated at double its rated capacity. In fact, the tabulated results showed that, as the flow of steam was increased, the water rate was reduced. This reduction, moreover, was particularly noticeable at the lower powers, where, at about one tenth power, a saving of 17½ per cent was effected merely by doubling the steam flow through the turbine without changing the revolution—a result whose bearing upon the question of cruising speeds for naval vessels is apparent.

Important as are the gains in efficiency, they are, if possible, overshadowed, particularly for naval installation, by the great saving which may be secured in weight and space, the effect of which in increasing the fighting power of a battleship without increasing its displacement is referred to later in this article.

The principal mechanical and operating advantages of this drive which have recommended it so strongly to naval engineers are: One, that high steam pressures may be used with superheat and that the turbine may be started quickly from the cold condition without danger of casing distortion and blade stripping. Two, the smaller size permits the turbine casing to be made

COMPARISON OF BATTLESHIP MACHINERY WITH AND WITHOUT REDUCTION GEAR.

| | Parsons Turbine Direct Connected. | Westinghouse Geared Turbines. | Saving Per Cent. |
|---|---|---|---|
| Shaft H. P. for 21 knots speed | 32,000 | 29,200 | 8.75 |
| R. P. M. Propellers for 21 knots speed | 230 | 160 | |
| Number of Turbines | 8 (4 different sizes) | 8 (all same size) | |
| Number of Propellers | 4 | 4 | |
| Weight of Turbines and Gears | 600 tons | 300 tons | 50 |
| Weight of Turbine Rotor (largest) | 30 tons | 1.8 tons | 94 |
| Number of Turbine blades (about) | 1,000,000 | 120,000 | 88 |
| Number of Feet Turbine blades (about) | 270,000 | 21,000 | 92 |
| Weight of Largest Turbine complete | 120 tons | 11.1 tons | 91 |
| Floor space occupied | 4,752 sq. ft. | 3,168 sq. ft. | 33.3 |
| Weight of largest piece of turbine | 30 tons | 4 tons | 86 |
| Steam consumption per S. H. P. full speed turbines only | 11.75 lbs. | 11 lbs. | 6.4 |
| Total steam, all purposes, full speed | 417,000 | 362,000 | 13 |

in two parts, with the elimination of circumferential joints and reduced cost of manufacture. Three, the shorter and lighter rotor makes possible the use of a stiffer shaft and the practical elimination of vibration with its consequent blade trouble. Four, the upper half of the casing may be hinged and the turbine readily opened for inspection. Five, the very great reduction in the number of blades greatly lessens the danger of blade stripping. Six, the smaller size of the turbine makes it possible to place the condenser directly beneath it—thereby securing a minimum loss of pressure and eliminating the large and cumbersome exhaust pipe—and use the shell of the condenser as a foundation for the turbine.

**What Reduction Gear Would do for the "Nevada."**

By way of illustrating the advantages in the way of space and weight saving and the more convenient size of the parts to be handled in repairs and overhauling, we present the accompanying tabular comparison and some diagrams showing eight small turbines geared in pairs to each of the four propeller shafts. The comparison speaks for itself; but we cannot refrain from drawing attention to the reduction of 50 per cent in the weight of turbine, to the fact that the weight of the largest rotor is reduced from 30 tons to 1.8 tons, that of the largest turbine complete from 120 to 11.1 tons, and that of the largest piece of turbine from 30 to 4 tons. Furthermore, it should be noted that the reduction of 13 per cent in the total steam used will mean a further reduction in the weight of the boiler plant and in the weight of coal carried for the same cruising radius.

**A Twelve-gun "Nevada."**

Now the reduction in the boiler plant and accessories due to the 13 per cent saving in steam used, would at a very conservative estimate secure an additional saving of 50 tons of weight, which, added to the saving in turbine weight, means a total saving of 350 tons in motive power alone. And this, the naval architects will tell you, means that there will be about an equal amount of weight saved in the ship itself, making a total saving by the introduction of the reduction gear of some 700 tons. This, in turn, means that the two 2-gun turrets of the "Nevada" could be increased to 3-gun turrets, and thus we would secure an improved "Nevada" of only 27,500 tons, carrying twelve 14-inch guns, which is the battery that will be mounted on the 31,500-ton "Pennsylvania."

The ten-gun "Nevada" costs about twelve million five hundred thousand dollars. The twelve-gun "Pennsylvania" costs about fifteen million dollars. The extra two guns and larger turrets on a reduction gear driven "Nevada" would fairly well offset the saving in weight of motive power. If this be true, a twelve-gun "Nevada" with reduction gears could be built for $2,500,000 less cost than a twelve-gun "Pennsylvania" without reduction gears; which would mean that it would be possible to build six twelve-gun "Nevadas" for the same cost as five twelve-gun "Pennsylvanias."

This article is not intended as a criticism of the design of the "Pennsylvania." The increase of 4,000 tons over the "Nevada" covers not merely the additional two guns and their mounting, but many features, presumably, in the way of better protection, larger fuel supply, etc. We merely wish to point out that the "Nevada," the most completely armored ship in the world, can be made to carry two additional 14-inch guns by a mere redesign of her motive power.

We commend these facts to the serious consideration of the Bureau of Construction and Repair and that of Steam Engineering when they come to prepare the plans for the three new battleships which the Secretary of the Navy will recommend to Congress.

## New York Electrical Show

THE New York Electrical Exposition and Motor Show of 1913 opened at the Grand Central Palace, Wednesday, October 15th, and will continue until Saturday, the 25th, inclusive.

The exhibition is well supported by the Federal Government. The Department of Agriculture illustrates with pictures, models, and maps what the Government is doing toward the protection of our forests. There is an erosion model which shows the effect of streams on denuded land as against well-forested country. The methods of signaling and fire fighting form an interesting part of this exhibit. The Department of Commerce and Labor illustrates how statistics are tabulated by the Bureau of Census with electrically operated punching and sorting machines that take card records at the rate of 450 a minute. Another popular exhibit of this department is a model of the Pedro Miguel lock of the Panama Canal. The model, 20 feet long and 5 feet wide, shows the actual operation of passing boats from one level to the other. The Department of the Interior is represented by a model of an anthracite coal mine in operation, and shows how in the modern mine nearly everything is done by electricity. The attention given by the Government to units and measures of electrical quantities is demonstrated in the exhibit of the Bureau of Standards; while the Reclamation Service shows what is being done in the West in the development of water power for the generation of electricity. In one corner of the building there is a fully equipped mint showing the process of manufacturing coin from the crude material to the final stamping press. The United States Navy is represented at the exhibition by the bridge of a battleship in regular working order, which demonstrates the electric signaling devices used on our war vessels. In addition to this, deep-sea sounding apparatus and navigating instruments are shown. Field wireless and time firing apparatus for coast defense guns form the interesting features of the United States Army exhibit.

In addition to the Federal exhibitions there is a State exhibit of model locks and spillways on the Barge Canal, while the Bureau of Municipal Research also shows how the affairs of New York city are now being conducted.

One of the special features of the present show is the part that electricity is now playing in medical matters. The section devoted to electro-therapeutics comprises more than a dozen separate exhibits. One of these consists of a model hospital, where every conceivable form of electrical apparatus has been installed for the benefit of the patient and the surgeon. There are high-tension machines, galvanic machines, sinusoidal machines, machines for ultra-violet light treatment, X-ray machines, electric incubators, bath cabinets, electrically heated blankets, etc. Particular stress is laid upon the use of Roentgen rays in locating trouble in various parts of the body. In this electrical hospital may be seen a large electro-magnet with which iron and steel particles may readily be removed from the eye or from the skin.

As usual, the growing use of electricity in the household holds a prominent position in the exhibit. There are the customary devices for cooking, cleaning, washing, etc., which have now become standardized and show only minor improvement over those exhibited in previous years. At one side of the second floor is the electrical grill and tea room where electrically cooked meals are served. One electric power company demonstrates what can be done in the equipment of a building for electric lights, including all the fixtures, on an expenditure of $69. Another company advertises to fit up any city house within its area of operations for $49. This company also shows what can be done for 10 cents by the use of various electrical apparatus and appliances.

On the top floor of the exhibition hall there is an electrical farm and dairy. Four white cows are daily milked by electricity. The method of clarifying the milk, separating it, pasteurizing the cream and churning it into butter, all by means of electrical apparatus, is here shown. The farm also includes a poultry yard and chicken hatcheries where baby ducks and chicks are hatched during the exhibition.

Illuminating engineering is well represented by various types of lamps. Special attention is shown to the reproduction of daylight by which colors may be matched. To demonstrate the ruggedness of tungsten lamps a bumping device is used which subjects the lamp to severe jars without injuring the filament. The new nitrogen-filled lamp will probably be on exhibition before the show is over. This lamp, as our readers know, will operate with very high efficiency, consuming but ½ watt per candle-power against 1 to 1¼ watts of the present tungsten lamps.

The motor truck is well represented by any number of exhibits which demonstrate the increasing use of the electrical commercial vehicle in the city and in places where electric current is readily available. At the top floor of the exhibition, there is a demonstration track and an electrical garage, completely equipped with battery charging apparatus, demonstrating the simplicity of the charging operation.

## The Destruction of the Zeppelin Airship "L II"

AS we go to press news is received of the terrible disaster in which the new Zeppelin naval airship "L. II." was totally destroyed. It is said that the vessel exploded in midair and that every one of the twenty-eight officers and men on board lost his life. Among those who were killed were members of the Admiralty Board, who were testing the airship before accepting her for the government. It would be both unwise and unsafe to venture any discussion of this, the most frightful accident which has occurred not only in the history of Zeppelins, but in the whole history of aeronautics. Our readers may rest assured that a critical discussion of the catastrophe will appear in these pages as soon as trustworthy information is received from Germany.

In last week's SCIENTIFIC AMERICAN a brief description of the "L. II." was published. The vessel, it will be remembered, was the most pretentious thus far constructed by the Zeppelin Company. She had a length of 487 feet and a beam of 50 feet. Indeed, she was so large that a special shed had to be constructed in order to build her. Unlike previous Zeppelins, she was provided with three cars instead of two. The third new car was the equivalent of the bridge of an ocean-going steamer; for it was used only to navigate the craft. The passageway connecting the cars was contained within the hull and was not suspended beneath it, as in the past.

No airship thus far constructed has ever been so powerfully engined. The "L. II." was driven by four separate engines in two separate engine rooms. The total output was 900 horse-power, enough to drive the craft, under favorable conditions, at a speed of over fifty miles an hour. A trial trip undertaken on September 6th last was considered satisfactory.

## New Railway Signal Experiments in France

ONE of the leading French railroads is engaged in making trials of apparatus for giving automatic signals to the engineer upon the locomotive in connection with the usual track signals, and in order to test the method on a large scale it is fitting out the lines from Paris to Dijon and other sections to the extent of 250 miles of double track, upon which there are 268 disk signals. As many as 140 locomotives are equipped with automatic devices, and these consist of an electric contact brush mounted under the front of the locomotive, and in the middle of the track. At the proper place the track has a short piece of electric rail which is curved so that it rises for a certain distance and the brush can make the contact with the surface. The current thus enters the locomotive and works a magnet device for a steam whistle placed near the usual one, but having a lower tone, and this shows the presence of a "stop" signal at the point in question. Combined with the usual speed chart is a device for registering the present signal. The engineer then cuts off the special whistle by pulling upon a cord.

## The Current Supplement

IN this week's issue of our SUPPLEMENT Mr. J. J. Ide gives an account of the recent aviation meet at Rheims, France, and the contest for the Gordon Bennett Cup.—Messrs. Langmuir and Orange's paper before the American Institute of Electrical Engineers on their work on the nitrogen-filled tungsten lamp will be published in full in this and the following issue.—Mr. J. W. Fewkes' article on stone monuments is concluded in this issue.—There is a common impression that the staling of bread is due to its drying, i. e., to loss of moisture. A recent investigation by Dr. Katz, reported upon in this week's issue, has shown that this impression is erroneous and that the staling of bread represents a reversible change of state similar to that of red mercury iodide into the yellow variety.—The interaction between passing ships, which, it will be remembered, led to a serious accident to the "Olympic" and the "Hawke" soon after the former was launched, has been made the subject of a careful investigation by Prof. Goodson in collaboration with Mr. J. H. Thompson. Their report is published in this week's SUPPLEMENT.

# Correspondence

*[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]*

## The Ten Most Needed Inventions

To the Editor of the SCIENTIFIC AMERICAN:

I am very much interested in the results of the contest "What Are the Ten Greatest Inventions?" I would also like to know from you or your readers what are the ten most needed inventions or discoveries.

Baltimore, Md. WILLIAM HUNT.

## Wanted: A Humane Animal Trap

To the Editor of the SCIENTIFIC AMERICAN:

The publication of the appeal signed by George Foster Howell for a humane animal trap, which appeared in the September 13th issue of your valued journal, is a step in the right direction.

I admire the humanitarian motive that prompted Mr. Howell to write you, for to anyone capable of reading between the lines must appear in all its horrible details the death agony of millions of animals which have been caught and crucified in this barbarous manner, viz., by the old-fashioned steel trap with its terrible cruel grip.

May I suggest that if one of the humane societies would offer a prize of $500 through the SCIENTIFIC AMERICAN for such a humane animal trap, which would immediately kill without torture, it would be forthcoming within a year. A. JOCELYN H. MAGRATH.

New York city.

## A Possible Case of Telepathy

To the Editor of the SCIENTIFIC AMERICAN:

I quite agree with your reply to Mr. Richardson on the law of magnetic communication between human beings. The analogy between telepathic and wireless telegraphic communication seems to me most remote.

A recent circumstance, which seems more than "coincidence," has upset my ideas as to any law of telepathy.

Last winter, as wife of a State Representative, I spent a large part of the three months' session as a visitor in the galleries. I knew the sergeant-at-arms in the most desultory way. I spoke to him probably not more than half a dozen times during the session.

About two weeks ago, the thought of Mr. B—— came to me repeatedly one afternoon. I remembered an act of kindness to my husband. I thought of his conduct on certain stormy occasions in the House of Representatives. Quite suddenly the thought came to me that he was in trouble. Irritated at spending so much time and imagining on a comparative stranger, I resolutely turned my thoughts elsewhere.

The next day's paper contained an account of his death by drowning on the previous afternoon.

This seems more to me than accident. I am positive that I had not once before thought of him since the close of the regular session in March. MRS. X.

Austin, Texas.

## A Plea for an Increased Patent Office Force

To the Editor of the SCIENTIFIC AMERICAN:

As yours is a scientific journal, it is to be presumed that you will welcome any suggestions that may offer a feasible remedy for the congested condition of the United States Patent Office. It will be observed from the weekly reports of the *Official Gazette* that the number of applications awaiting official action is steadily increasing, and it is obvious therefore that the Office force is entirely inadequate to cope with the business of the Office, and some solution of the problem must soon be devised, or the interests of inventors and the people at large will suffer in consequence. On May 13th, 1913, the number of applications awaiting action was 27,465, and on September 30th the number had increased to 30,128, this being an increase of 2,663 in four and one half months, or a yearly increase of about 7,000. From these figures it is obvious that Congress should provide a remedy for the existing evils, which are becoming greater every year, and that must soon be remedied or our whole patent system will be greatly impaired in its usefulness. Because of these facts will you allow me to offer a few suggestions, having in view the expediting of business in the Patent Office? First, that the number of divisions be increased from forty-three to at least fifty, and that the Office force be increased in like proportion; and second, that the number of applications pending in the various divisions be equalized as nearly as possible, so that inventors of all classes of inventions will stand an equal chance in the allowance of patents. Now it will be observed that there is a great disparity in the number of applications pending in the different divisions; in nine there are over 1,000 in each, and in two of these there are over 1,600 in each, while in sixteen other divisions there are less than 500 in each division. Now it is obvious that these disparities in numbers should be adjusted, unless there be some substantial reasons for their retention shown to exist and that do not admit of a remedy. The inventors of our country and the world pay the entire expense of the Patent Office and leave a surplus of $68,000 yearly to the Government, as clear gain. Now in view of these facts, are they not clearly entitled to the very best of service and an early allowance of all patents where the necessary conditions are complied with? EDWARD W. OWENS.

Wagner, S. Dak.

## How the Indians of Peru Use Coca Leaves

To the Editor of the SCIENTIFIC AMERICAN:

An article in your issue of the SCIENTIFIC AMERICAN of September 20th attracted my notice, under the title "What is Coca?"

I thought perhaps it might be of interest to your many readers to say something more about the way, and to what extent this plant is used, principally by the Indians of Peru, particularly in the high altitudes.

In the latter part of 1910 and early part of 1911 I was at La Fundicion and Cerro de Pasco, Peru, an altitude of over 14,000 feet. I saw there the Indians chewing these coca leaves, and they surely must be a powerful restorative and stimulant. To illustrate: One day, while it was snowing and raining, an old Indian, ragged, dirty, and altogether a picture of misery, ambled in to the lumber yard, and directed his weary steps to a large pile of lime, which was partly exposed to the rain. There he sat down and drew his pouch of coca leaves around to the front, and commenced to fill his mouth with them. After this procedure, he stealthily reached down and picked up a piece of lime about the size of a hazel nut and put that in his mouth with the leaves. I was secretly observing his actions, and waiting for the expected effect. In about two minutes the old Indian's face was wreathed in smiles, and he glanced furtively from one side to the other as if he expected someone to intrude or disturb his pleasant sensations. When he thought all was secure he threw out his chest, and commenced to take notice of his torn and dirty clothing. A torn place in the knee of his trousers seemed to annoy him considerably, for he repeatedly tried to fold it up and stroke it away, as if he expected it to disappear entirely, and would occasionally fleck away a particle of dust.

The power of endurance of these Indians is surprising to Americans. Men, women, and children are scarcely more than beasts of burden. I saw an Indian boy not over fourteen years of age and not over eighty pounds in weight carry one hundred pounds of coal up a long hill for several hundred yards without resting.

The women are often seen with one hundred or one hundred and fifty pounds of coal in a poncho, struggling up a hill, with a baby perched upon this poncho, and the old woman spinning llama wool, which is wrapped around her left forearm to a spool and spindle. She spins with her right hand, with apparently no thought of the load she is carrying.

I suspect that the women use coca leaves as well as the men, and also the children to some extent. Almost every Indian man is equipped with a pouch, made from a cow hide or the hide of some small animal, with the hair always on the outside.

These leaves sell in this locality at five cents per pound. I am inclined to believe that coca leaves are used more extensively in Peru than in Chile, for I was in the Andes Mountains in Chile and never remember having seen them used by the natives engaged in similar work to that of the Indians of Peru.

Miami, Ariz. W. H. REAGAN.

## Repelling Aeroplanes from the Ground

By C. Dienstbach

So far as military flying is concerned, the real lesson taught by the Balkan campaign was the need of some effective method for repelling air scouts. As every military officer foresaw, the ordinary rifle proved far more efficient than artillery in forcing aviator scouts to withdraw. Field cannon cannot be discharged at high angles, and even howitzers have their limitations in that respect. The experimental aerial artillery thus far constructed fails to meet other obvious requirements. The repelling of torpedo boat attacks by battleships requires special ordnance which must be capable of very quick handling if it is to be effective at all. Yet this lesson, taught by every navy in the world, seems to have been quite lost upon those who seek to provide our armies with artillery for the repulsion of aeroplanes. What is needed is evidently an aerial gun so mounted on a pedestal that the pointer can handle it like a rifle, raise it at an elevation of 70 to 80 degrees, swing it around and aim it by means of a shoulder rest or butt.

It is worth mentioning that in 1871 Krupp made such a gun for the express purpose of bringing down the balloons which easily escaped from Paris during the siege. It is obvious that the caliber of such a gun must be small, so that the piece may be swung quickly without the aid of mechanism. Large caliber is less essential because shrapnel is not very efficient if the range is not only unknown, but also subject to quick change. Moreover, long ranges must be attained, not by large caliber, but by high initial velocity in order to carry the shell as quickly as possible to the target; otherwise it will be necessary to aim so far ahead of the rapidly and irregularly moving object that exact firing is out of the question and all aiming merely guesswork. Long range is essential because adjustable sights are in a way useless against aircraft. Only a point blank fire can reach a prying aviator with any degree of certainty. It is very important to note that the point blank range increases with the angle of sight. At 90 degrees it is infinite; at 80 to 70 degrees it is well-nigh 80 to 70 per cent of the total range.

In the light of all this it is not difficult to understand why the high-powered modern muskets used in the Balkans, which met most of these requirements, succeeded as well as they did against aeroplanes. They could be quickly and readily pointed at the steepest angle, and the high initial velocity of their needle-pointed bullets gave them a very great point blank range. These needle-pointed bullets, invented not so many years before the flying machine's advent, seemed actually to have anticipated the military aeroplane itself. They increased the horizontal point blank range from 800 to some 1,500 feet. No wonder that in the recent war the Balkan pilots soon felt safe only at the great height of 6,000 feet. The highest sight of a rifle exceeds a horizontal range of 6,000 feet by very little; yet 2,500 feet above Adrianople a Russian pilot on the Bulgarian side missed death by the luckiest chance, three bullets piercing the floor of his car. The German pilot Scherr, with the Turks, tells of four rifle balls that hit the planes of his machine. Three of them pierced members of the frame at a height of 4,000 feet.

The effect of musketry fire against aeroplanes in the Tripolitan campaign was not so marked as in the Balkans because there were not enough skilled marksmen among the few Turkish regulars and the many Arabian irregulars to whom a modern rifle was not a mysterious piece of mechanism. The seasoned men of a European standing regular army, all familiar with modern muskets, would have given a better account of themselves.

An aeroplane over an enemy's position draws the concentrated fire of hostile marksmen, who may be scattered over a great expanse of ground and therefore among their great numbers invariably include whole crowds of exceptionally skilled sharp-shooters.

At 5,000 feet an aeroplane seems so small that it is hard to find when once lost from sight. High skill in marksmanship is essential to hit it. Because rifles are always more numerous than cannon, a company of marksmen may make it uncomfortable for an aeroplane even though its height be 5,000 feet. At that distance from the muzzle the actual scattering of the bullets, even from a rigidly held rifle, is such that a certain percentage of hits is almost sure to be scored. Hence it becomes very essential to armor the men and the vitals of machines. Since the striking energy of a bullet after it has reached a height of 5,000 feet is comparatively low in spite of its tremendous penetration at shorter ranges, very light armor will serve its purpose.

## Panama Hat Industry in the Philippines

One of the ambitions of the enterprising Philippine Bureau of Agriculture is to introduce the Panama hat industry into the Philippines. The plant from which these hats are made, *Carludovica palmata*, is now cultivated in Java, where hats are being woven from its leaves by Javanese women and children, and the product is said to compare favorably with the common grades turned out in South America. The method of preparing the leaves is very similar to that used in the Philippines in preparing sabutan leaves for weaving sabutan hats. The Filipinos are skillful hatmakers, and in certain parts of the islands hat weaving is the chief household industry. Experiments in cultivating *Carludovica palmata* are now under way at the Lamao and La Carlota experiment stations in the Philippines.

## A Radioactive Iron Mud

The famous St. Antal spring in Austria delivers radioactive water of marked therapeutic value, but it has been shown recently that the mud deposited by the spring has a much higher radioactive value than the water. This is the more interesting because this mud is mainly iron oxide, $Fe_2O_3$, which on heating, dissolving, reprecipitating and drying yields increased activity. Since the emanation acts differently from those of radium, thorium and actinium it is concluded that there must be present some new radioactive element similar to ferric iron.

An overhead conveyor system.

A completed section.

Sewer ready for the arch forms.

# The Passaic Valley Sewer

## Plans for Securing Wide Diffusion at the Outlet in New York Bay

FOR the last twenty miles of its course, the Passaic River is little better than an open sewer. The sewage from a population of two thirds of a million pours into this sluggish stream, and its bottom is clogged with deposits that have accumulated for years. The liquid and floating matter move leisurely into Newark Bay, and eventually find their way through the Kill von Kull into upper New York Bay, whose waters are already surfeited with sewage from New York city; thence in due course they reach the ocean. A small part of the sewage also passes through the longer course provided by Arthur Kill and Staten Island Sound into the lower bay.

For years the Passaic River has been considered a menace to health, and it was decided some time ago to parallel the river, from Paterson on, with a large trunk sewer which would intercept not only the sewage that now pours into the river, but also that of several more towns included in what is known as the Passaic Valley District. The area of this district is eighty square miles and it contains twenty communities or townships. The total population thus served would be about three quarters of a million. At the present rate of growth, it is estimated that in 1940 there should be 1.6 million inhabitants in this area. The principal contributors to this sewer must always be Paterson at the head of this sewer, with 125,600 inhabitants at the present time, and Newark at the mouth of the Passaic River, with a population now of 347,469.

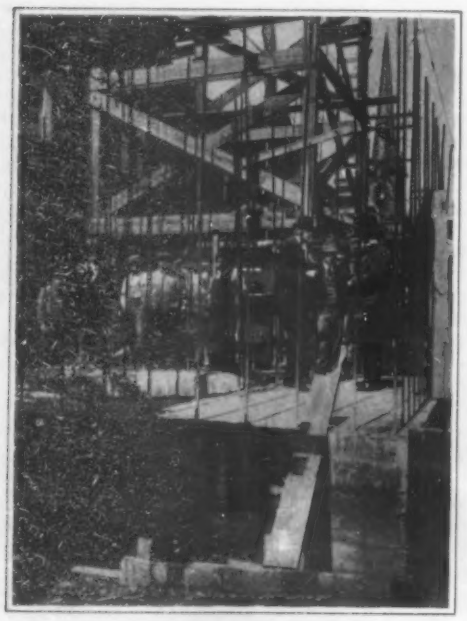
As Newark Bay is cut off from direct communication with the ocean, it is planned to run the sewer under Newark Bay, and directly into upper New York Bay, at Robins Reef within the New Jersey State line. However, this has led to a great deal of opposition upon the part of New York State, which contends that the sewage must pass through New York waters before it can find its way to the ocean, and New York's sewage problem is bad enough now without having to take into consideration the sewage from a neighboring State. On the other hand, New Jersey has agreed to establish a treatment station on the west shore of Newark Bay, where the sewage will undergo a thorough mechanical purification. The Passaic Valley Sewerage Commissioners guarantee that there will be absence of suspended particles, of objectionable deposits, and of odors due to putrefaction of organic matters contained in the sewage that pours into New York Bay; that there will be practically no grease or color and no injury to public health, or to the property of the United States situated in the harbor of New York; and that there will not be enough reduction in the dissolved oxygen content of the waters of New York Bay to interfere with major fish life.

This guarantee is made with the indorsement of the United States, which intervened between the two States, and which, with the assent of New Jersey, shall have representatives designated by the Secretary of War to inspect the conditions and working of the sewer system at any time, to determine whether New Jersey is living up to its contract. Thus New Jersey claims that the new sewer will be a blessing rather than a nuisance to New York, for the very sewage which now flows into New York Bay through Kill von Kull will undergo a thorough treatment and purification before discharging into those waters.

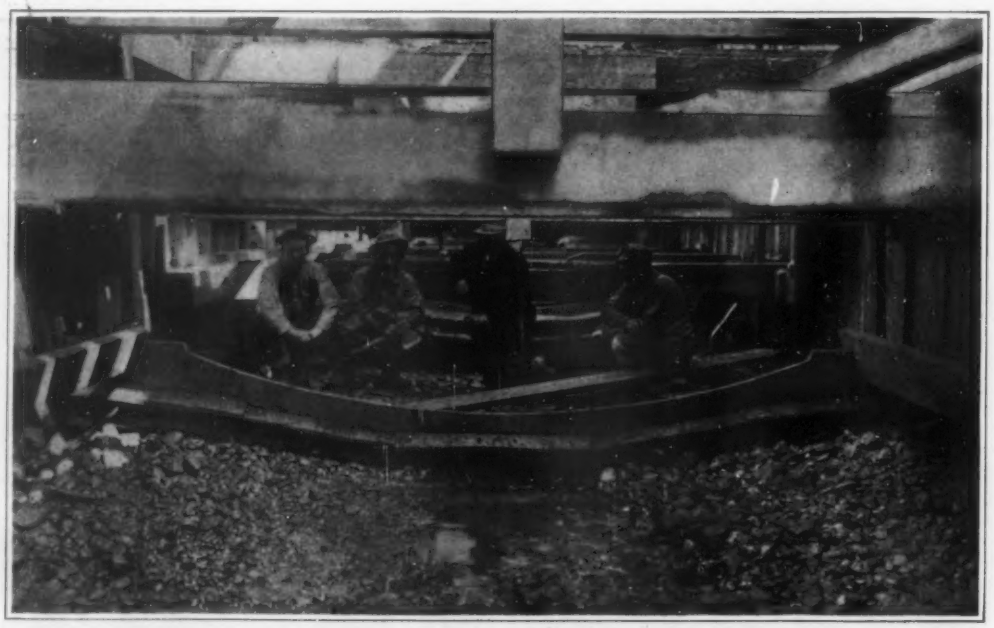
The method by which New Jersey expects to carry out her part of the contract is interesting. The sewer, which will start with a diameter of 3 feet 9 inches in Paterson, will rapidly increase in diameter to 9 feet at Passaic, 10 feet at Nutley and 11 at Newark, reaching the pumping station at Newark Bay with a diameter of 12.6 feet. Here it will lie at an elevation of 26½ feet below mean low water, and will pass through treatment works which will be described below. To carry the sewage under Newark Bay a pressure tunnel will be driven through rock 200 feet below sea level. The tunnel will be 12 feet in diameter. On the other side of the bay it will rise to 80 feet below sea level, and will continue at that level to New York Bay, terminating at an outfall station at Robins Reef, two miles offshore. Here it will rise to 25 feet below sea level, so that access may readily be had to valves for controlling the flow of the sewage. From the outfall station, pipes will carry the sewage down to a depth of 40 feet, before it will be allowed to discharge into the channel.

At the treatment station, the sewage will first pass through coarse screens to remove all floating matter, and then through grit basins and fine screens. Thereafter it will be pumped through sedimentation basins or settling tanks. Provision will here be made for removing grease, floating matter, and all solids, and the clarified effluent will be forced through the pressure tunnel to New York Bay.

The terminal station in New York Bay, as shown in our illustration, is an octagonal structure of concrete, with a facing of masonry, and protected by rip-rap. At this point the tunnel will connect with three outfall pipes, furnished with suitable valves. At present only two of these outfall pipes will be used, but provision is made for a third pipe which may be needed in the future. These outfall pipes are eight feet in diameter, and they will run down the sloping banks of the reef about 50 feet apart, until they reach a depth of over 40 feet below mean low tide. Here the outfall pipes will branch into discharge pipes, extending across the current and spaced a hundred feet apart. They will be laid in trenches on the bottom of the bay, and



Lowering a concrete caisson.



Laying the forms for the floor of the sewer.

will decrease in diameter, by steps, to two feet. Each of the discharge pipes will be fitted with a large number of tees, projecting from the top. The tees will be not more than one foot in diameter, and will be spaced about ten feet apart. They will have outlets arranged to discharge horizontally across the tidal current. Altogether there will be 150 of these diffusion nozzles, and they will be spread over an area of 3.5 acres.

Although the work on the outfall of the sewer has been delayed by litigation, the work on the main trunk sewer is progressing. The sewer will have a total length of 26 miles, two thirds of which is now under contract and 15 per cent of it is completed. The work consists largely of open ditching, but about 30 per cent of it calls for pneumatic tunneling. Most of the sewer is a concrete conduit of horseshoe shape. The accompanying photographs show some of the work in progress.

## An Aerial Derby to Commemorate the Tenth Anniversary of the First Flight Ever Made in an Aeroplane.

ON October 13th an aerial derby was held in New York city, under the auspices of the Aeronautical Society, in order to commemorate the tenth anniversary of the achievement of human flight. It was on December 17th, 1903, that Wilbur Wright flew 852 feet at Kitty Hawk, North Carolina. No more striking evidence of the advance which has been made in aviation since that memorable day could be offered than the performances of the machines that flew over Manhattan Island. All told, seventeen aviators entered, but only five made the flight. The start was made from the grounds of the Aeronautical Society at Oakwood Heights, Staten Island. The course was around Manhattan Island, a distance estimated roughly at 60 miles. A stiff northwest wind was blowing at the rate of 43 miles an hour, which put the skill of the pilots to the test. The best time was made by W. S. Luckey in a 100 horse-power Curtiss biplane. His elapsed time was 52 minutes and 54 seconds. Next came Frank Niles, also in a 100 horse-power Curtiss biplane, who covered the distance in 54 minutes and 55 seconds. C. Murvin Wood in an 80 horse-power Moisant monoplane finished third, and his elapsed time was 58 minutes and 15 seconds. The fourth was J. Guy Gilpatrick, who piloted an 80 horse-power Sloane-Deperdussin over the course in 1 hour 9 minutes and 62/5 seconds. Tony Jannus finished last in a 75 horse-power Benoist biplane, his elapsed time being 1 hour 14 minutes and 7 seconds. The New York *Times* offered three prizes of $1,000, $750, and $500 to the men who finished first, second and third, respectively. The Aeronautical Society offered a silver cup to the three aviators who finished first, second, and third.

One of the entrants was Albert J. Jewel, who left Hempstead, L. I., on the morning of the derby, intending to land at the starting grounds. He has not been heard from since. Two fishermen saw him drifting out to sea. It is probable that, losing his way above the clouds, he perished after his gasoline gave out.

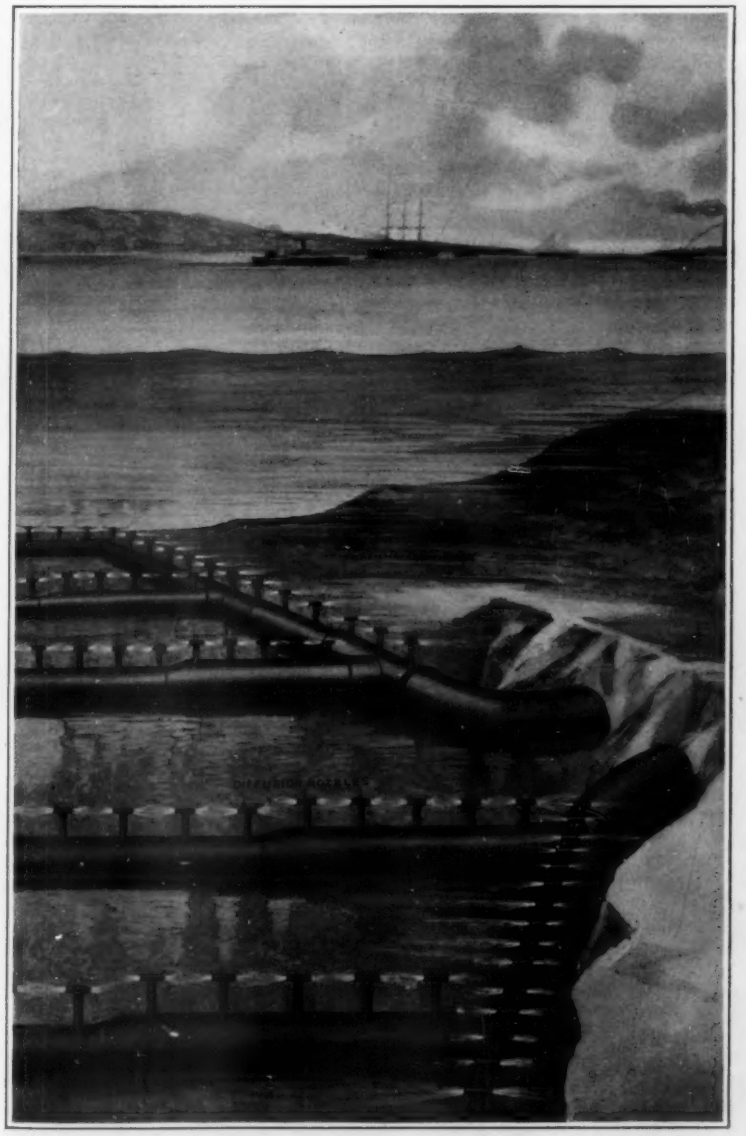
Course of the Passaic valley sewer and territory served.

## The Balloon Race for the Gordon Bennett Cup

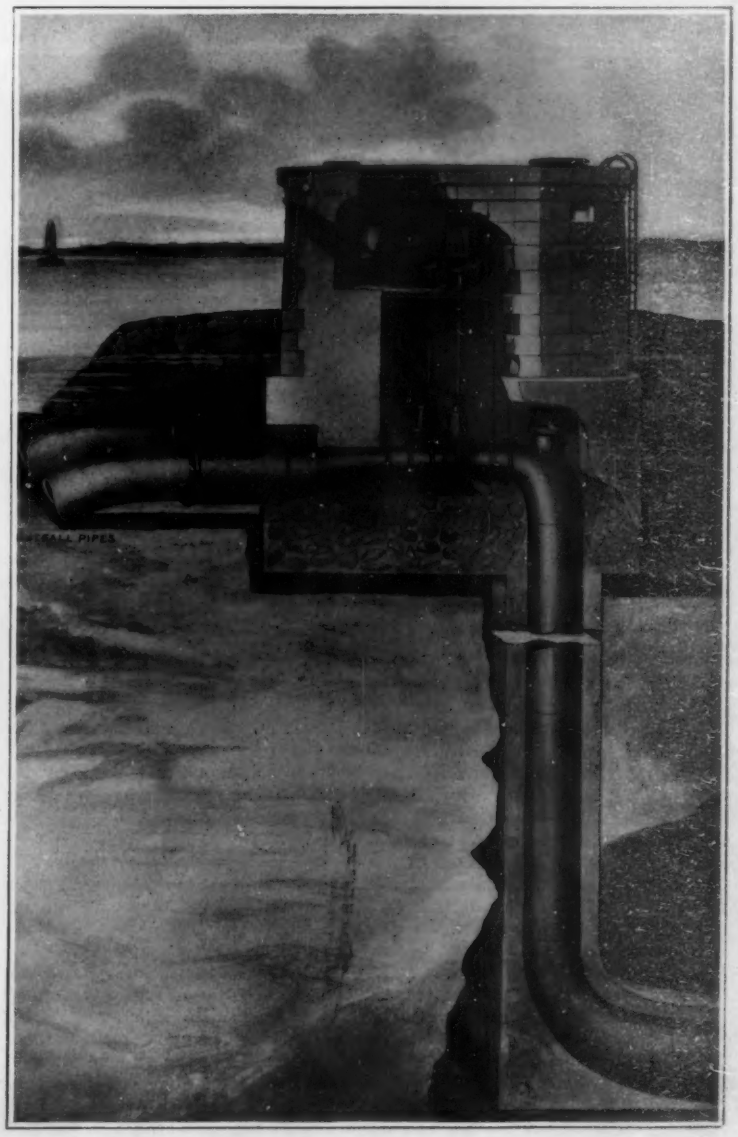
THE international race for the Gordon Bennett Cup, which started from Paris on Sunday, October 12th, was won by the American balloon "Goodyear," which, with Ralph H. Upson and Ralph A. D. Preston on board, covered about five hundred miles. The American balloon "Uncle Sam," piloted by Capt. H. E. Honeywell, landed after a flight of about 250 miles on the French coast south of Brest. Third in the race was the Italian balloon piloted by Agostini. It also descended on the French coast. The "Goodyear" was the only balloon to cross the English Channel. Landing within a few yards of a steep cliff on the northeast coast of England, on Bompton cliffs, near Flamborough Head, it narrowly escaped disaster. The men on board descended simply because of fog, mist, and wind.

## The Passing of the Sailing Ship

THIS is the theme of a report from the American consul at Hongkong, and is illustrated in the statistics of that port. Just one sailing ship entered Hongkong in the year 1912, as compared with 688, one fourth of the total entries, in 1876. No sailing ship of European type is now engaged in regular trade to Hongkong, and even Chinese junks are being robbed of local business by power vessels of various kinds. In the fiscal year ended June 30th, 1912, slightly over 4 per cent of the tonnage entering ports of the United States from foreign countries represented sailing vessels, while in 1884 such ships made up more than 42 per cent of the total entries.



Method of securing a wide dispersion of the sewage where it discharges into New York Bay.



The terminal station of the Passaic Valley sewer where the pressure tunnel connects with the outfall pipes.

# The Work of Aircraft in the French Maneuvers, 1913

## Aircraft Were Not Conspicuous, But Nevertheless Extremely Useful

By Major H. Bannerman-Phillips

THE most stringent precautions were taken this year to preserve the secrecy of the orders and movements of the two adversaries. The result was to increase the realistic side of the operations, but at the expense of information. Not only, too, have spectators seen very little, but the commanders themselves, and even their staff officers, have found it most difficult to keep in touch with the course of events. Besides taking cover in woods, by the side of hedges, in buildings, among bushes, and under carts and wagons, and even railway trucks, during daylight, the troops in a contemporary battle (which may last for days) will often march by night. By day they will file, like Red Indians, under trees and hedgerows, or lie still in the long grass awaiting the moment to strike. Every precaution has to be taken so that the enemy may not discern movements or direct the distant fire of his heavy artillery on the closed ranks of a marching column. The result is to increase the difficulty of commanding every sort of unit and to make the art of war far more of an intellectual exercise than it has been even in the recent past.

Mist and rain complicate matters and the French airmen had both these and the night marching of the enemy to interfere with their observations.

The basis of the grand maneuvers of all arms in France was the victualing of the armies, for which both fresh and chilled meat was to be used, the employment of the aeronautical services, and the transport in connection with these two services, in the area which lies between Auch, Agen, Montauban and Toulouse, the southern army being based on Toulouse, the northern army on Agen. Aviation camps specially organized, so that they could be struck and packed on the lorries, ready for transport, in less than an hour, were formed at each of these last two places.

Each side had three "escadrilles" of aeroplanes with complete transport and reserve. The "escadrille" has been standardized as the French military aviation unit, and its personnel and material are designed with the object of keeping six aeroplanes permanently in the field. The short period of the maneuvers can only give an approximate idea of the wear and tear which the strain of an actual campaign would bring to bear on both the human and mechanical components of this unit, but fairly conservative British estimates based on the experiences of the work of instruction at Salisbury Plain and Farnborough give a very short life to a heavier-than-air machine in constant use. The British Secretary of War has stated that if it is required to have 100 aeroplanes ready to fly at any given moment, there must be 200 in hand, and his critics maintain that in order to have 100 aeroplanes efficient and ready for war it is necessary to buy 300 *additional* machines or the equivalent number of spare parts each year. Again, the strain on pilots of aeroplanes is out of all proportion greater than on the pilots of dirigibles, and the present estimate of the probable period of efficient flying on active service is three months, if the aviator is not to risk physical and nervous breakdown, and the same remarks apply to aerial observers. Matters will alter for the better in this respect no doubt as time goes on and machines improve, but that is the reasoned opinion of experts at present.

The transport for an "escadrille," accordingly, is intended to carry, besides the personnel, a generous proportion of the spare parts, the field hangars, workshops, and aeroplanes themselves, complete, but dismounted. All vehicles are motor-driven except the two-wheeled "prolonges" for carrying aeroplanes, and these have a limber attachment, like that of a field-gun, by which they are hitched as trailers to motor vehicles.

The complete transport consists of three motor cars and two motor cycles (for inter-communication purposes), six heavy cars, each drawing a two-wheeled trailer or "prolonge," and two traveling workshops. These last are of similar type to those employed by the British Royal Flying Corps at maneuvers this year and known as the "Delahaye" traveling workshops.

The equipment comprises a lathe, drilling machine, grinder, shaping machine, band saw and circular saw, each driven by its own electric motor, whose actuating current is supplied from a dynamo driven, when the car is at rest, by the 20-30 motor. Fitters' and carpenters' benches are included in the equipment as well as a full complement of metal and woodworkers' tools.

The driver is situated over the engine, thus economizing the available length. For somewhat more than half the body-length the lower half of the side swings downward to the horizontal, supported at the outward corners by strong legs, thus forming a valuable extension of floor space; the upper portion hinges upward, forming a roof to the extension, and a curtain is provided against the weather. The machine is constructed to climb very steep gradients and to traverse the worst country.

It stands to reason that much money and brains have gone to the making up of these excellently organized and carefully thought-out transport units, and they have stood the test of maneuvers well, both last year and this year.

Last year the work of the aeroplanes attracted much attention; reconnaissances were carried out daily at the hours appointed on a programme regardless of the weather, and the opposing commanders were on the whole kept constantly and accurately informed of the movements of the enemy's troops. No serious accident was sustained by any of the pilots, though some of the machines suffered considerably. The aeroplanes ready for action all assembled at the place of concentration, prior to the commencement of the maneuvers, by way of the air and returned home by the same route. Since then a great campaign has been carried on in France by individuals and societies for increasing the rate of progress in military aviation, improving the *matériel* and organization, increasing the trained personnel by passing young men through the aviation schools before they do their military service and providing landing places with hangars all over the country.

Numbers of aeroplanes have been bought by various provinces, societies, commercial houses, and private individuals and presented to the Government as voluntary contributions in token of their sense of the importance of French aerial supremacy. The manhood of France which passes through the ranks has the enlightenment to understand the importance of the development of aerial efficiency for war purposes, and acts accordingly.

Last year the aeroplanes at the maneuvers were the cynosure of all eyes. Much was expected of them, and they did much, but their work was not so systematic as it might have been. The pilots were mostly picked men, but the aeroplane service was in the main more or less of the nature of a keen irregular volunteer force.

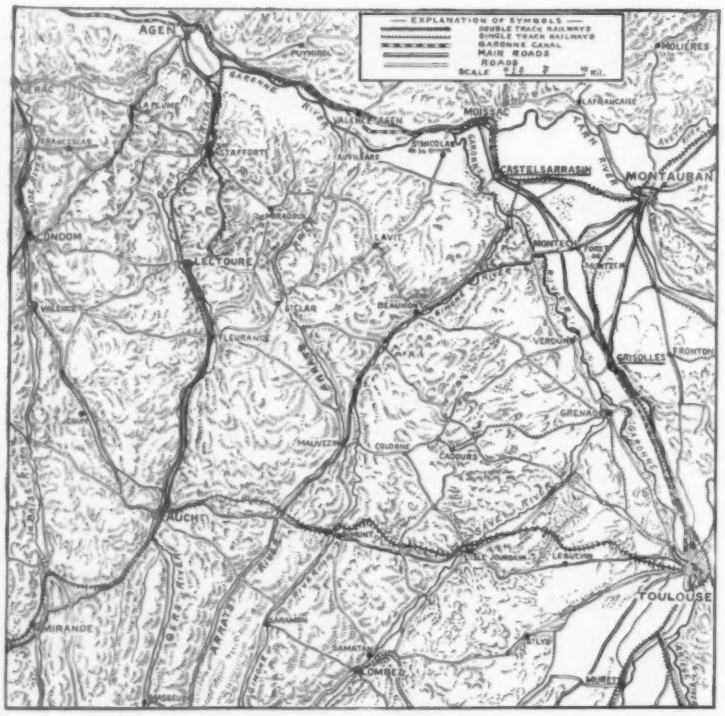
Although at this year's maneuvers aeroplanes have not been seen as frequently, the work performed by them has been better organized, but there has been little or no selection of individuals, either as pilots or observers, for special duties. Instead of the airmen being left to roam more or less without a definite object over disputed country, they have been dispatched to different points with specific missions to fulfill. From the experimental point of view it is on the use of the motor and not on the aeroplane that attention has been concentrated. An elaborate trial of the motor car was made in the victualing of the troops, but the most important test was that made with the new French heavy field gun, which is intended to reply to the 105-millimeter and 130-millimeter Krupp guns of the German army. These guns were drawn by specially-built motor tractors of 35 horse-power, which are provided with a drum and chain cable so as to enable them to pull the heavy guns out of soft ground. The tractors can carry a weight of 2,500 kilogrammes, and they can in addition draw a weight of 15 tons behind them. Their speed is 15 kilometers per hour, and they can climb a gradient of 10 in 100 with a full load. The southern army had seven of these machines, which drew two carloads of shells and a heavy gun on its carriage.

If the aeroplanes did not catch the eye their performances were nevertheless signally useful and much appreciated by the generals and their staffs. One army commander declared that, thanks to his air scouts, he really knew more about the enemy's movements than about those of his own troops.

The operations were under the personal direction of Gen. Joffre, chief of the general staff, assisted by Gen. de Castelnau; this latter officer subsequently attended the British army exercises at the latter end of September.

The forces were divided into a northern and a southern force; the former, consisting of the twelfth and eigh-

(Concluded on page 327.)




Scene of this year's French maneuvers.

Motor traction played an important part in the French maneuvers.

## Auto Goggles for a Horse

THE accompanying photograph would seem to indicate that the horse in the picture had gone in for motoring, but that is not the case. He needs them in his business, which is that of drawing a cart of refuse from a Los Angeles gas works to a briquetting machine that converts it into fuel. The dust and smoke are so injurious to the eyes that the driver adopted auto goggles for his own use, and then devised a pair for his faithful beast. They are not pretty, but they give solid comfort.

## Brick Pavement in a Washout

AN object lesson in the proper grouting of brick pavements was disclosed by the recent Ohio floods. The roadway was invaded by a small creek which rains had swelled to the proportions of a river. A stone retaining wall was wrecked and half the roadway washed out. The concrete base fell away in pieces, but the brick surface stands to-day apparently as firm as ever and capable of bearing the weight of an automobile. The unsupported portion of the brick is eighty feet in length and seven feet in width. The road will be refilled and tamped laterally beneath the paving.

## The Pedrail Motor Truck and Trailer

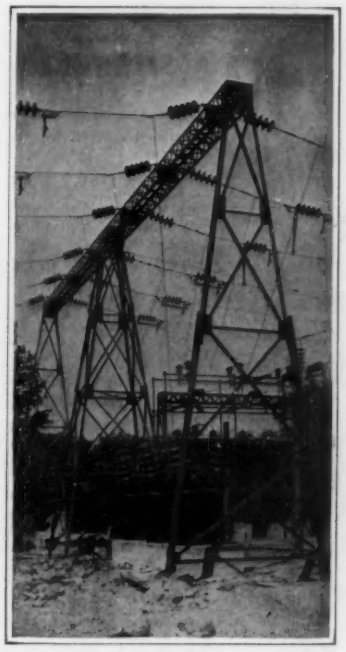
IT is some years since the original pedrail steam road locomotive made its appearance in Great Britain, and in the meantime many important developments have been made, which have culminated in a motor vehicle and train working upon the same principle. This system aroused considerable interest at the recent Commercial Motor Exhibition in London. It is the eighth vehicle of its type, and in its design many important new features have been embodied. The most salient of these new details is the introduction of an antifriction spring-roller chain of novel design, whereby friction is reduced to an insignificant point, the flange and axle friction which existed in former models having been eliminated entirely.

The machine has a perfect walking action, similar to that of a centipede, in which respect it differs materially from the so-called "caterpillar." Each foot is possessed of a perfectly articulated ankle, which gives it the desired freedom of motion while negotiating road obstructions. An ingenious means of causing the feet to approach and to recede from the ground horizontally while preserving equal spacing, has been perfected by bringing the suspension rails into different planes when guiding the foot carriers. The horizontal approach of the feet to the ground allows of their close proximity when taking or about to take a load, and also prevents any obstructive matter such as stones and so forth from being caught and squeezed between them.

Each pedrail places two and three feet on the ground alternately, and the force exerted by compressed springs is so adjusted that any two feet together can carry the load for which they are designed, while one foot alone would be unable to do so. Consequently, when an abnormal load is thrown upon a single foot it simply rises, and the obstruction is passed over without the customary jolt experienced in other vehicles. When three feet come into play, the load still is supported only, there being no lifting effect. This is because the springs are incapable of more than a certain definite extension. The springs mentioned above are compressed by bolts threaded through them, the bolts thus being held vertically, while their lower extremities are free to move sideways, like the clapper in a bell, and are attached to the foot, which thus is capable of a certain side motion controlled by the springs, and which is brought into play when negotiating a corner.

A motor-driven pedrail vehicle can be used for hauling trailers. These wagons are of similar design, but for steering purposes a device known as a "hinged joint" is employed to attach the trailing wagons to the tractor. This is a cast steel framework carrying a worm attached to the front vehicle and operated by the driver. The worm engages with a worm-wheel sector on the rear vehicle, thus enabling steering to be effected by using this vehicle in the manner of a rudder. A motion, controlled by a pivot and guide in the hinged joint, allows either vehicle to tip sideways, independently of the other. One important feature of the mechanism is that since the two wagons are hinged vertically about a point between the centers of the two vehicles, the pedrails of the rear wagon traverse the same tracks as those made by the one in front. Consequently, if a train of wagons is used the last car follows in the tracks made by the tractor.

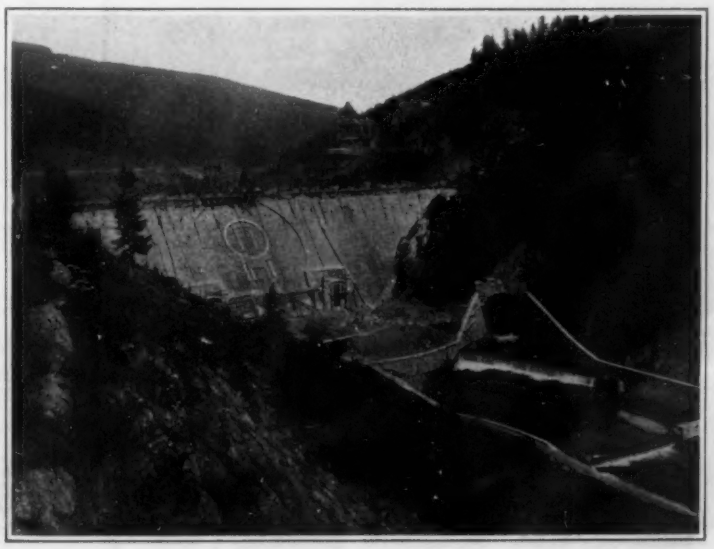
Auto goggles to protect a horse's eyes from dust.



High-tension open-air switching station.

A washout that did not disable a brick-paved road.

Pedrail motor-truck and trailer.



Ornamenting a dam in Austria.

## Safeguarding Operators in Open-air Substations

THE progress of the past three or four years in the design and construction of substations for very high voltage service has been so rapid along the lines of securing suitable insulation and mechanical support of conductors, that unless one has seen one of the latest out-of-door types of installation for 60,000-volt operation or over, it is not easy to realize how far present standards are from work that only lately would have been thought perfectly satisfactory by transmission engineers. The accompanying photograph taken during the construction of an out-of-doors switching station in Massachusetts illustrates this point. The importance of adequate support for the incoming 66,000-volt lines is so great that structural steel bridges 30 feet high and about 60 feet long have been erected to support the strain insulators carrying the line conductors and the disconnecting knife switches which are always opened before any work can be done on a neighboring oil switch or other piece of apparatus in series with the section. As shown in the photograph the oil switches are taller than a man's head and are mounted on solid concrete foundations to cut down vibration in operation. The insulating bushings by which the lines enter and leave each switch are of huge proportions in comparison with earlier equipment, and the strain insulators are of the disk type, found so satisfactory on steel tower lines. The erection of such an outdoor switching station is a matter of a good many weeks, as every detail must be cared for perfectly to insure safe operation, and every high-tension line wire must be run so directly that by no possibility can the operator mistake it for another. In this station a portion of the overhead work is designed for 110,000-volt service, and the wires are spaced from 6½ to 10 feet apart. Wooden platforms will enable the disconnecting switches to be handled more effectively when the installation is completed.

## Ornamenting a Dam

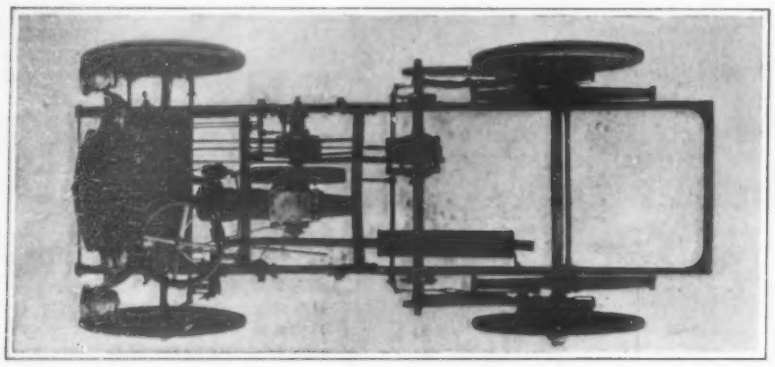
IN the SCIENTIFIC AMERICAN of a recent date we published an article on the growing tendency to beautify engineering works, as far as possible. This has led one of our readers residing in Denmark to send the accompanying photograph of a dam that is being built across the Elbe at Spindelmühle, in Austria, which shows that the same tendency prevails in Europe. The dam, which is to be completed in two years, is being built by Italian laborers, because the Italians are more skilled in stonework. The material for the structure is obtained from a nearby quarry.

---

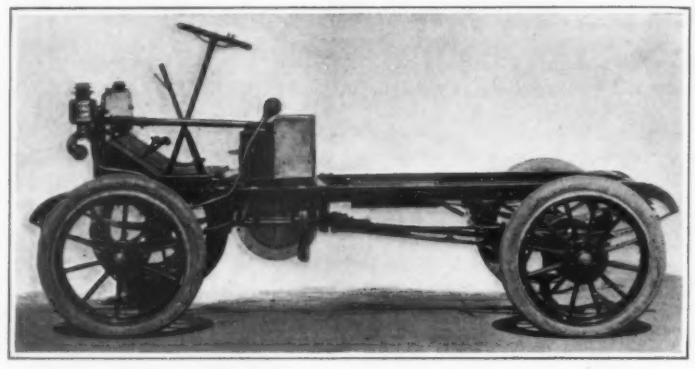
**A Novel Amusement Device.**—Clarence E. Bedient of Pleasant Ridge, Ohio, has secured a patent, No. 1,063,949, for an amusement device in which a track having rollers supports a hull which is adapted to travel upon the rollers and also to navigate upon water. The hull has an air propeller and a slip is provided to guide the hull from the water on to the track and means for propelling the hull from the water onto the track.

# The Motor-driven Commercial Vehicle

*This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.*



A three-chain drive.



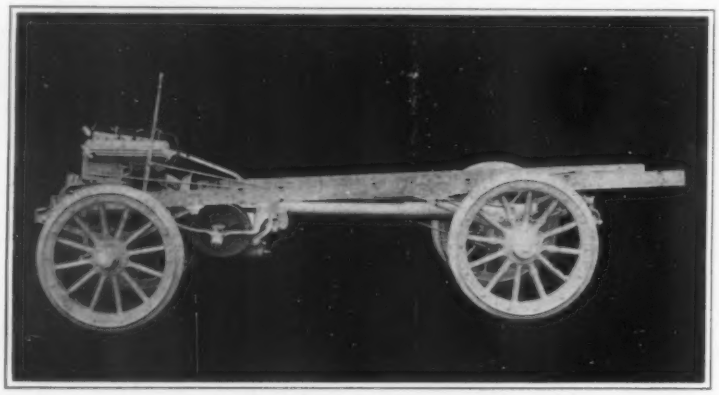
A friction-wheel drive.

## Methods of Drive in Commercial Motor Vehicles

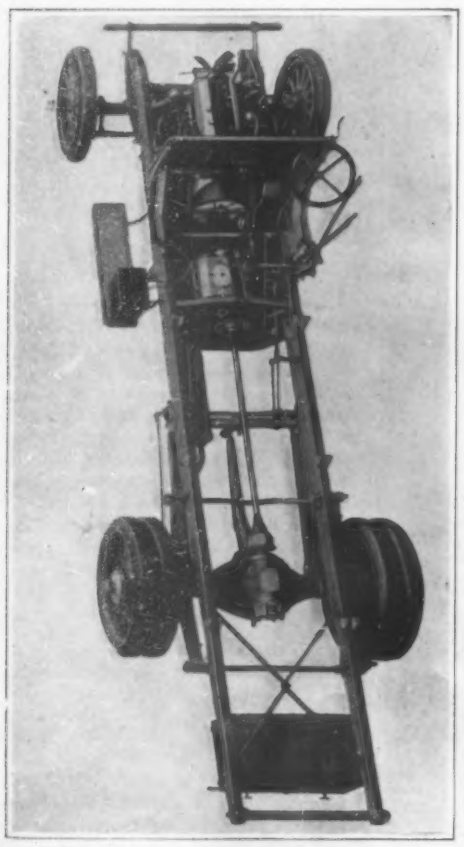
By Ross Babcock, M.E.

WHEN first the commercial motor vehicle came into practical existence the question as to what method should be adopted for the final drive to the rear axle or to the rear wheels, as the case might be, was one that was readily answered and admitted of little or no argument. At that time the chain for power transmission was more satisfactory, from a motor vehicle point of view, than anything else, and as a consequence the chain and sprockets formed the last step in transmission of power from the motor to the road wheels in nearly all of the early machines; and that the judgment of the pioneer engineers was not at fault is indicated by the fact that notwithstanding the progress that has been made in other forms of final drive, the chain is in evidence in more machines than is any other one means of effecting the final drive.

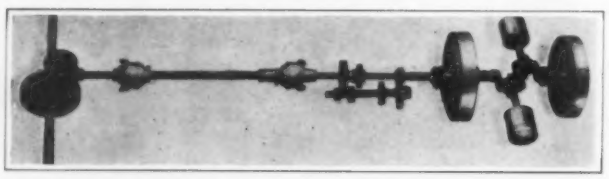
Whether or not the chain will maintain its supremacy is a question that is difficult to answer in the face of the improvements that have been made in other means of transmitting power and the resulting multiplication of final driving systems. Chains have been made vastly better than they were in the days of pioneer motor building; the application of scientific principles in design and construction and the employment of modern steels have had the effect of greatly reducing transmission loss and of increasing the strength and lengthening the working life of the chain and the sprockets, and the chain is the most satisfactory means available for the final drive of the heaviest motor trucks, while it is freely used in machines of all sizes and types, down to the very smallest. Improvements have been made with at least equal rapidity in other directions, and for certain classes of machines the chain is being supplanted by more recently developed mechanisms. Bevel gears, at one time extremely wasteful of power and prone to rapid wear and noisy operation, spur gears, the link belt or so-called "silent" chain, internal spur gears—all have been brought to stages of excellence that permit their satisfactory employment in both light and heavy machines, to say nothing of the most recent development, the worm drive, which in its original form had nothing to recommend it except compactness and quiet running. It is not going too far to say that to-day the differences that exist in the matter of transmission efficiency between the best examples of various drive systems are so slight as to be of but little moment as compared with other considerations, such as compactness, convenience, adaptability to general design and so on. The worm, like the bevel gear, requires close and tight housing for the purpose of excluding dust and dirt and retaining lubricant. Thus they work at all times under very favorable conditions, so far as lubrication and protection are concerned. The chain, on the other hand, is a somewhat difficult thing to inclose, and as a result the vast majority of chain-driven machines run with chains and sprockets exposed to the dust, which



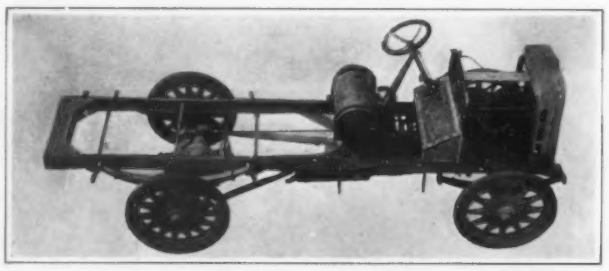
Combined friction and worm drive.



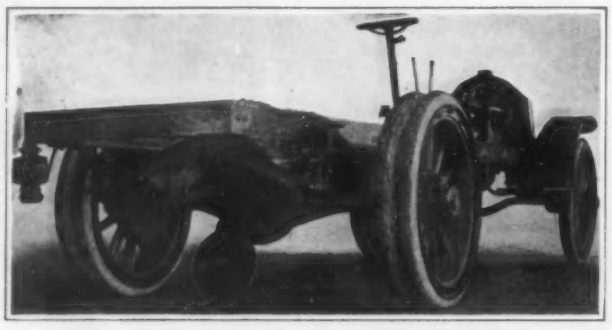
A typical worm drive.



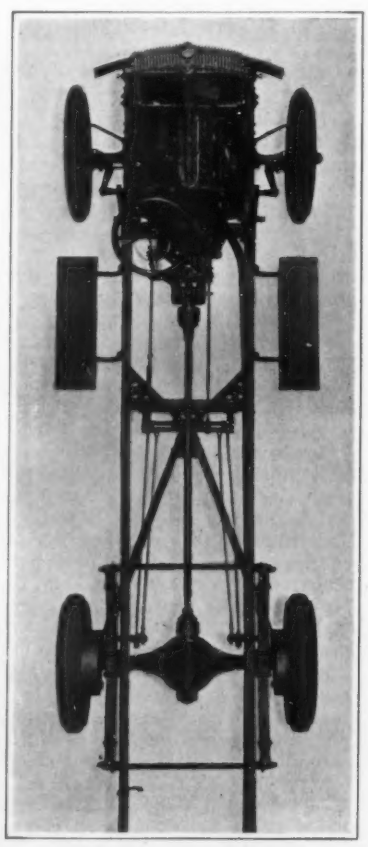
Double reduction shaft and spur drive.



Internal gear drive.



Worm gear and its housing.



Overhung worm drive.

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*Inquiry No. 9327.* Wanted to get in touch with a patentee of some article requiring a small amount of capital and selling ability.

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*Inquiry No. 9329.* Wanted, names and addresses of patentees of useful household utilities preferably for use in the home laundry or kitchen. This inquirer wishes to correspond with a view of purchasing patents outright.

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*Inquiry No. 9331.* Wanted, a machine for separating the veins of feathers from the shaft of the feather.

*Inquiry No. 9332.* Wanted, a machine for perforating patterns for transferring on linen.

*Inquiry No. 9334.* Wanted, name of manufacturer equipped to manufacture electric vacuum cleaner to be made from aluminum and pressed steel or both, also manufacturing aluminum castings for same.

they gather freely, to the shortening of their lives and the decreasing of their efficiency. The fact that chains will operate even fairly satisfactorily under such untoward conditions explains in no small measure the persistence and popularity of the chain drive.

In the commonest form of chain drive two chains drive to sprockets bolted to the inner faces of the road wheels, transmitting power from a countershaft mounted on the main frame of the vehicle forward of and parallel with the rear axle and carrying the differential gearing. The countershaft is commonly driven by bevel gears from the tail-shaft of the gearset, the housing of the differential gear and that of the gearset being either integrally formed or else bolted together to form a rigid unit. In the heaviest class of trucks this system is practically alone, while in machines of from three to six tons carrying capacity it is more in evidence than any other method. In lighter machines employing chain drive there is more variation in the method of using chains, if for no other reason than that the difficulty of meeting requirements as to strength is much less, and consequently there is more latitude for considering other things. In some very light vehicles the rear axle is of the live type and the differential carries a sprocket which takes the single chain. This arrangement is often employed in small commercial vehicles with planetary change-speed gearing mounted on an extension of the crankshaft of the horizontal motor—a type of power plant and transmission that is well adapted to and very often used for light service. Light trucks with friction disk transmission of power also are fitted with single chain drive, in some cases the chain being of the silent type and inclosed.

While it has been said that the double chain drive is more commonly employed than any other one form of final drive, it should not be forgotten that bevel gear drive is the almost invariable complement of side chain drive, the bevels driving the countershaft, as already mentioned. Considering the matter from this point of view, a little of the importance is lifted from the chain and shifted to the bevel gear. The bevel, however, is becoming of increasing importance as a final drive pure and simple. There can be no doubt that its development in the pleasure car field, in which it is practically the only system of final drive, has done much to further its use in commercial cars, not only through example, but because the system has been so far perfected that it can be subjected to the stresses and the wear and tear of commercial service without fear of undue trouble either from wear or breakage. Given a pair of properly generated bevels with accurately finished and hardened teeth, the chief requirement is an absolutely rigid mounting that will permit the requisite close adjustment of the gears and will prevent movement tending to destroy the accurate alignment, once secured. Obviously the bearings must be of a sturdy type capable of withstanding the necessarily heavy loads without excessive wear and adapted also to support the driving bevel pinion at a point as close as possible to the teeth. For this purpose ball and roller bearings of several forms are employed with satisfactory results. Stresses other than those due to torque are avoided by introducing universal joints at one or more points between the tail-shaft of the gearset and the bevel pinion. The propeller shaft may be run through a tube forming a unit with the differential housing, in which case the shaft forms practically an extension of the bevel pinion shaft, or it may be jointed at both ends, in which case the inclosing tube may be, and usually is, omitted.

Worm drive is peculiarly interesting because it illustrates the fact that what man wants man will usually get, if he knows enough and tries hard enough. The worm drive in use before the advent of the automobile was crude, to say the least, by comparison with the present type. It was extremely quiet in operation, however, was compact and had the advantage of giving a large ratio of reduction in a

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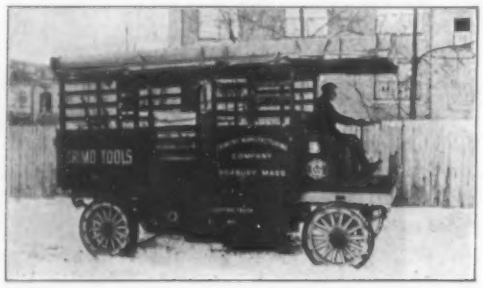


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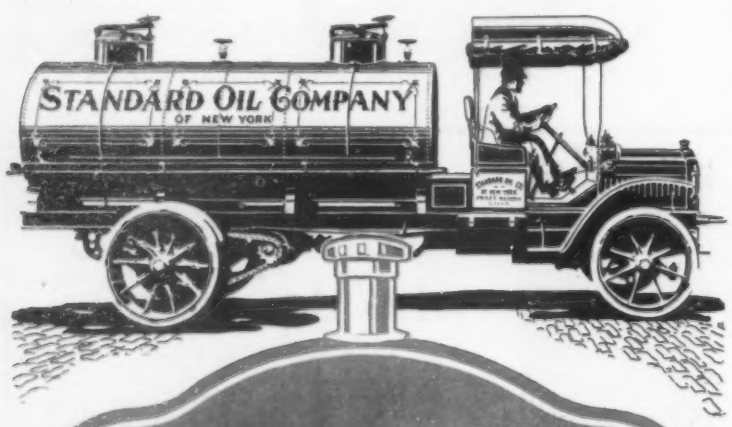


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single step—all qualities that are of the utmost importance in automobile engineering. By dint of the application of modern methods the worm was brought to a state of efficiency that even now is not altogether credited in some cases, and it has been applied to the driving of machines of widely varying capacities—from the lightest to the heaviest, in fact. While the worm commonly is designed for a live-axle drive, as is the bevel gear drive, there are machines both in Europe and in this country in which the rear wheels are driven each by a separate worm. Shafts extend along the sides of the car to housings which inclose the worms, worm gears and the wheel bearings, which are of unusually heavy and accurately fitted construction so as to maintain the relative positions of the worm and the worm gear. As in the case of the bevel gear drive, it is of extreme importance that the worm and worm gear should be very rigidly supported so as to prevent relative movement—in fact, this is a point that is of greater moment in worm gearing than in any other form of power transmission, for the slightest inaccuracy of alignment necessarily results in an enormous increase of friction; and lubrication, copious and unfailing, is absolutely essential to the worm, which operates wholly with a sliding action and depends upon accuracy and smoothness of finish of its surfaces and upon their separation by a film of lubricant for its efficiency—assuming, of course, proper design in the first place.

Worms are used in both overhung and underhung forms—that is, either above or below the axle. The usual reason for underhanging the worm is to insure lubrication, and in overhanging the road clearance under the axle is increased.

The least common final drive is that in which the rear wheels run on a dead axle and are driven by spur gearing, the wheels carrying large gears, and pinions, meshing with the gears, being carried on the ends of a countershaft which is mounted close to the rear axle. Drive to the countershaft is effected by bevel gears, as in the case of side chain drive. It is usual to house the entire drive system, including the gears on the road wheels, for protection and for the furtherance of lubrication. Both internal and external gears are employed in this type of drive, though the internal spur is the most commonly used. By placing the countershaft directly over the axle and providing the ends with universal joints turning on the same axis as the steering knuckles, this drive can be employed for wheels that also are steering wheels, and this has been successfully done in a number of instances where it has been desired to drive through the front or through all four wheels.

## The Motor Truck and the Freight Terminal

THE interesting suggestions of Mr. Robert L. Niles, published in the SCIENTIFIC AMERICAN of September 27th under the above heading, were accompanied by a tentative local solution of the problem. This solution, which was omitted at the time because of limits of space, is as follows:

Each city terminal presents its own problem, though solution follows general lines.

In the city of New York an average of 7,000 freight cars arrive and depart daily. The majority of such tonnage is handled by the following railway systems: Baltimore and Ohio, Erie, New York and Harlem, Central of New Jersey, Long Island, New York, New Haven and Hartford, Delaware, Lackawanna and Western, New York Central and Hudson River Railroad, and Pennsylvania Railroad.

With the completion of the Hell Gate bridge, all such roads will, or readily might, be inter-connected, and with all but limitless area and trackage surrounded by cheap real estate, and close to the eastern ends of both the Williamsburg and Queensboro bridges.

At the present time the freight transfers of the Baltimore and Ohio are at Cummunipaw or by lighter to various New York piers.

That of the Central Railroad of New Jersey the same.

That of the Erie at Jersey City or by similar transfer over water.

That of the Delaware, Lackawanna and Western at Hoboken or by water transfer to sundry piers.

That of the Long Island at Astoria or Long Island City.

That of the New York Central and Hudson River Railroad at Sixty-sixth Street, Thirtieth Street, St. John's Park and various piers on the North River. The Harlem Railroad at Port Morris and in connection with the New York Central.

That of the New York, New Haven and Hartford Railroad at 138th Street, and by float to various East River piers.

That of the Pennsylvania at Jersey City, at Astoria, Long Island City, and by water transfer to various down town, North River piers.

Each of such points of distribution is restricted in area and accessibility, costly to maintain, and in many cases absolutely impossible of expansion and in every case only extensible at enormous expense.

In its infancy it is impossible to decide upon details of installation and equipment, but it can be seen that costly mistakes could hardly be made, that original equipment could hardly be valueless, that growth could be along the lines of experience and added equipment such as actual operation indicated, without discarding any previously acquired, and that profitable operation should follow even modest beginnings with the possibility of limitless growth and, through experience thus gained, lead to the installation of similar systems in other centers of distribution. The field of operation is limited only by the combined tonnage of the entire transportation methods of the country, and the sum total of the congested terminals.

## Are Men Better Typists Than Women?

(*Concluded from page 816.*)

with their disks, or weights. Two of the buckets are made of aluminium and weigh 1 gramme (15.4 grains) each; the others are of copper and weigh 10, 100 and 1,000 grammes (about 1/3 ounce, 3 1/2 ounces and 35 ounces). The disks of each series are 10 in number and range from 1 to 10 units in weight, the unit representing 1/10, 1/100 or 1/1,000 the weight of the standard bucket. The subject is blindfolded and seated in a comfortable position at a table. The examiner gently suspends the standard bucket of 100 grammes weight from the second joint of the subject's index finger, where it is left hanging for 5 seconds, and is thrice "hefted" by raising the forearm. The standard is removed, and is replaced, 3 seconds later, by the other 100-gramme bucket, loaded with an additional weight of 9 grammes. The subject is asked which bucket is the heavier. The experiment is repeated, with progressively increasing overweights, until the question is always answered correctly. The limit of muscular sensibility is expressed by the ratio of the added weight to the weight of the standard bucket.

The essential feature of the d'Arsonval chronoscope (Fig. 4), employed in measuring the auditory reaction time, is a clock with a single hand or pointer, which makes one complete revolution in each second, in front of a dial divided into hundredths. A Foucault regulator (rotary fan or "fly") assures constant speed for about ten minutes. An axis made in two parts, of which one is permanently connected with the clock train, and carries a felted disk which can be caused to engage with a toothed disk on the other part of the axis, transmits the movement to the pointer. Behind the toothed disk, which is made of soft iron, is an electromagnet which draws the toothed disk away from the felted disk and keeps the pointer motionless while the current is passing. When the circuit is broken the toothed disk, no longer attracted by the magnet, is pressed against the rotating felted disk by a spring and the pointer moves over the dial.

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In measuring the auditory reaction-time with this chronoscope M. Lahy seats himself opposite the subject and holds in his hand an exciter (Fig. 5), which serves to produce a sound by striking a gong and at the same time opens the circuit of the electromagnet.

The subject, with face averted and eyes bandaged, holds in his hand a little apparatus, by pressing which he closes the circuit the instant he hears the sound. The reaction-time, or the interval between the emission and the perception of the sound, is measured by the space traversed by the pointer on the dial, which can be read to 1/100 or 1/200 second.

In the final test the relative strength of the right and left hands is determined by means of the Régnier-Chéron dynamometer (Fig. 2). This instrument contains a spring which is compressed with the hand, but the pain produced by the rigidity of the spring inhibits muscular effort.

Moreover, the dynamometer takes no account of the very important factor of rapidity in muscular contraction. Hence, its indications are of doubtful value, but the results obtained by Lahy appear to prove that persons having hands of equal strength produce the best work on the typewriter.

Let us now examine the psycho-physiological indications of excellence in the typewriting art, as they are given in the tables published in M. Lahy's description of his experiments. One fact is apparent at a glance. Although the results obtained from men and women exhibit a general similarity they are not identical in detail. All good typists show the same marks of superiority, but the psycho-physiological differences between the men and the women make it necessary to study their performances separately, and then to compare the two series of results thus obtained. If the men and women are listed together, in the order of excellence in various respects, the highest places will be occupied by men in some of the lists and by women in others.

Good women typists usually exhibit a marked development of tactile and muscular sensibility, and an excellent memory for letters and especially for concrete phrases. The right and left hands are nearly equal in strength and their attention is keen and well sustained. Their relative slowness of auditory reaction is a theoretical defect, but the value of a typist depends rather upon a combination of good points than upon a great superiority in one particular.

Men exhibit greater uniformity than women, but the differences between good and poor typists are nevertheless well marked. In general, men surpass women in rapidity of auditory action and, consequently, in speed of work, but are inferior to women, perhaps, in power of sustained attention.

These conclusions, however, are based upon too small a number of observations to allow them to be affirmed positively and with conviction. The results here given are merely indications which may be confirmed or invalidated by future researches.

## The Work of Aircraft in the French Maneuvers

*(Concluded from page 322.)*

teenth army corps, a colonial division, and a provisional brigade of cavalry, was commanded by Gen. Pau, while the southern army was led by Gen. Chomer, who had under his orders the sixteenth and seventeenth army corps and the sixth cavalry division. Altogether some 70,000 men were engaged in the comparatively flat country bordering the Garonne. Gen. Joffre's headquarters were established at Castelsarrasin on the Garonne canal. The northern, or Blue, force under Gen. Pau had three escadrilles of aeroplanes stationed at the aviation camp near Agen, comprising six Blériot monoplanes, six Henry Farman, and six Maurice Farman biplanes. The Red army's aeroplanes, stationed at Toulouse, were six Voisin and six Bréguet biplanes and six Deperdussin monoplanes. The fighting which took place was based on the following

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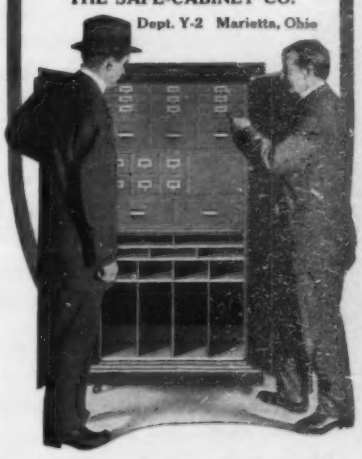

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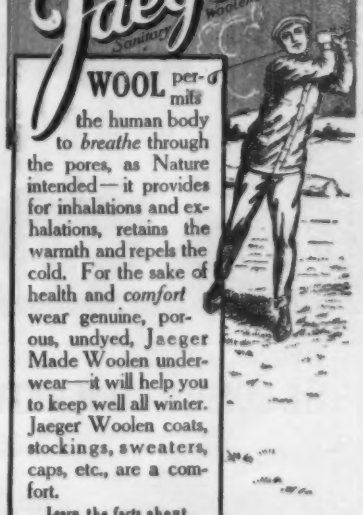

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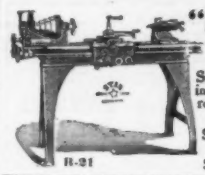
idea: "Both armies have been engaged on the north bank of the Garonne; the Southerners have been driven back and the Northerners compelled to halt to collect and supply their forces. The Southern army having been reinforced again seeks action, and the Northern force endeavors to cut the enemy's communications running southward from Toulouse." The systems of march adopted by the two armies is of interest; Gen. Pau sent forward his colonial division as a general advanced guard, behind whose protection his masses maneuvered in deep columns; Gen. Chomer, on the other hand, adopted the German plan of marching his whole force in parallel columns of equal strength, each comprising a division, or four columns in all. The front thus covered by the Southern army—some thirty miles—was nearly double the frontage of the Northern. The first period of the maneuvers closed on the evening of the 13th of September with a hard day's fighting, which, however, owing largely no doubt to the numerical equality of the two forces, left the issue undecided. The object of the Northern army was to deliver a crushing blow upon the adversary while it was still shaken by previous reverses, and before reinforcements could reach it from Cette and Toulouse. In the fighting which ensued Gen. Pau was successful on his left, but his right was forced to retire.

On that date the Northern army, commanded by Gen. Pau, was declared to be so far victorious that it had pressed back the enemy toward Toulouse, but Gen. Chomer's force had been able to escape actual disaster. On the evening of this day the Northern army held the left bank of the Gimone as far as Aubiet and Auch, while the Southerners were in occupation of the high ground between the Gimone and the Save. The 14th (Sunday) was more or less a day of rest, and there was not very much doing in the early part of the 15th, as operations were to take place that night. At 5 P. M. the Northern force began to move forward, the Gimone was crossed at several points, and the advance came almost immediately in contact with the outposts of the Southerners. These, however, were no more than a screen intended to conceal and cover the withdrawal of Gen. Chomer's troops, who retired, when pressed, to a strong position on the Save. The left was the weakest portion of the Southern defense, but the whole generally was so strong that it seemed unlikely that the defenders could be evicted in a single day's fighting. This proved to be the case; there was fighting throughout the 16th, and the maneuvers did not end until the following day. Gen. Chomer made the best defense possible before entering upon the inevitable retreat, and his attempt to cover this by attacking Gen. Pau's left was partially successful.

In the course of the maneuvers the Northern commander made some interesting and suggestive remarks respecting his aeroplanes. He addressed himself to the pilots and observers of all ranks, thanked them for the excellent service they had so far rendered, and demanded great efforts, so as to ascertain the dispositions of the Southern army before dark. (It turned out that these dispositions were not obtainable, because the enemy waited till dark before moving important forces.) While praising the brilliant performances of the gallant airmen, and the excellence of the material, which had worked throughout the maneuvers without an accident, the Northern commander said that a yet far more difficult task remained for the new arm in maintaining the "liaison" between neighboring army corps and divisions in the same army, and in keeping the commanding general informed of the progress and condition of his own troops.

The difficulty of inter-communication between the various components of a field force of large dimensions when engaged with an enemy in other than very open country and the desirability of using aircraft for these purposes, as auxiliary to other methods of conveying orders and information, have been emphasized by the French maneuvers and confirmed by later army exercises in England.

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The editorial staff of the SCIENTIFIC AMERICAN receives annually over fifteen thousand inquiries, covering a wide range of topics—no field of human achievement or natural phenomena is neglected. The information sought for in many cases cannot be readily found in text books or works of reference. In order to supply this knowledge in concrete and usable form, two of the Editors of the SCIENTIFIC AMERICAN have, with the assistance of trained statisticians, produced a *remarkable Reference Book*, containing over seventy-five thousand facts, and illustrated by one thousand engravings, for which the entire world has been scoured. Immense masses of government material have been digested with painstaking care with the collaboration of government officials of the highest rank, including cabinet officers, and assisted by competent professors of world-wide reputation.

The average business man would like to know the wireless rate for passing ships, how to compute his interest, or figure his discounts without trouble. The inventor wishes to know something of the patent laws and the fundamental principles which underlie them, as well as to have access to innumerable mechanical movements which will simplify his problem. Most people are curious about the weather, but how many can name the various clouds? We are all interested in the "Navy," but how few know the internal workings behind the walls of steel? Those who are planning a trip will find ocean rates and names of steamers, whether they are to go by the Atlantic, Pacific, or to Southern ports. Aviation, that wonderful and deadly new science, is here fully treated in a chapter, written by a world authority. Under railroads, we find such precise information as the pay of a Pullman porter, the average trip or price of fare, or the lantern signals of the conductor. The Panama Canal is described with the aid of interesting graphical comparisons. Competing high buildings are shown in scale.

The Scientific American Reference Book for 1914 has been completely revised and much new matter has been added. Over 60% of the pages have been corrected or new pages substituted therefor. In this work of revision the editors have again had the co-operation of the highest Government officials. The Scientific American Reference Book for 1913 was enthusiastically welcomed by the press and it is safe to say no other Reference Book in the English language has proved of such genuine merit and has stood the test of time so well. Every one who purchased a Reference Book for 1913 will want the 1914 editi The New York Sun says: "Those who know the Refere Book will want the new edition at once. Those who do will save time and money by getting it."


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